97TH CONGRESS } HOUSE OF REPRESENTATIVES { REPORT
2d Session } { No. 97-485

AUTHORIZING APPROPRIATIONS TO THE NATIONAL SCIENCE FOUNDATION

APRIL 26, 1982.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

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Mr. FUQUA, from the Committee on Science and Technology, submitted the following

REPORT

together with

ADDITIONAL AND MINORITY VIEWS

[To accompany H.R. 5842]

[Including cost estimate of the Congressional Budget Office]

The Committee on Science and Technology, to whom was referred the bill (H.R. 5842) to authorize appropriations for activities of the National Science Foundation, and for other purposes, having considered the same, report favorably thereon with amendments and recommend that the bill as amended do pass.

The amendments are as follows:

On page 4, after line 17, insert a new subsection (d):

> (d) Of the amounts authorized to be appropriated under Section 201(7), for Scientific, Technological, and International Affairs, no amount is authorized to be available for United States support of the International Institute for Applied Systems Analysis in Vienna, Austria, providing there is a final determination by the President, and notification to the Congress, that participation in the Institute is contrary to national security interests.

On page 4, line 18, strike (d) and insert "(e)".

On page 7 after line 18, insert two new subsections (c) and (d) to read:

> (c) Section 10 of Public Law 95-99, the National Science Foundation Authorization Act for FY 1978, is repealed.
>
> (d) Subsection 12(b) of the National Science Foundation Act of 1950, as amended, is deleted and the preceding subsection is redesigned by striking the "(a)".

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Purpose of the Bill

The purpose of the bill is to authorize appropriations to the National Science Foundation for fiscal year 1982 in the amount of $1,085,000,000 and $1,099,481,000 for fiscal year 1983, out of money in the Treasury not otherwise appropriated, and $3.3 million for fiscal year 1982 and $2.2 million for fiscal year 1983 in foreign currency which the Treasury Department determines to be excess to the normal requirements of the United States as follows:

BUDGET ACTIVITIES

	Authorization, fiscal year 1982	Authorization, fiscal year 1983
Research and related activities:		
Mathematical and physical sciences	$285, 400, 000	$288, 300, 000
Engineering	100, 400, 000	98, 600, 000
Biological, behavioral and social sciences	184, 600, 000	201, 000, 000
Astronomical, atmospheric, Earth and ocean sciences	253, 200, 000	250, 800, 000
Ocean drilling programs	14, 000, 000	14, 000, 000
U.S. Antarctic program	69, 600, 000	86, 400, 000
Scientific, Technological and International Affairs	46, 400, 000	50, 100, 000
Cross directorate programs	13, 200, 000	0
Program development and management	62, 200, 000	63, 081, 000
Science and engineering education	35, 000, 000	45, 000, 000
Modernization of research equipment and facilities	16, 500, 000	0
Total, NSF	1, 085, 000, 000	1, 099, 481, 000

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I. Summary

BUDGET ACTIONS

Budget Total

The President's budget included a request for $1,069,481,000 in new obligational authority for the National Science Foundation in fiscal year 1983.

H.R. 5842 includes new obligational authority totalling $1,099,481,000. This amount is a $30,000,000 increase over the Administration's request.

Increases

1. Biological, Behavioral, and Social Sciences is increased by $14.3 million to $201 million, of which $16.2 million is for additioanl funding in the social, behavioral and information sciences.
2. Scientific, Technological, and International Affairs is increased by $6.1 million to $50.1 million.
3. Science and Engineering Education is increased by $30 million to $45 million.

Decreases

1. The request for Mathematical and Physical Sciences is decreased by $10.4 million to $288.3 million, providing an increase over fiscal year 1982 of $15.4 million.
2. The request for Engineering is reduced by $1.1 million to $98.6 million, providing an increase of $6.6 million over fiscal year 1982.
3. The request for Astronomical, Atmospheric, Earth and Ocean Sciences is decreased by $8.9 million to $250.8 million, providing an increase of $8.9 million over fiscal year 1982.

Other

1. The committee directs that of the total amount authorized for Engineering, not less than $2 million shall be available for research to aid the handicapped.
2. The committee directs that of the total amount authorized for Scientific, Technological, and International Affairs, not less than $3 million shall be available for the National Research Opportunity Grants program.
3. The committee directs that of the total amounts authorized for Mathematical and Physical Sciences, Astronomical, Atmospheric, Earth and Ocean Sciences, and Engineering, not less than 10 per centum shall be available for research instrumentation.

OTHER ACTIONS

A. The bill was amended to provide that of the funds authorized for Scientific, Technological, and International Affairs, no amount is authorized to be available for United States support of the International Institute for Applied Systems Analysis in Vienna, Austria if there is a final determination by the President, and notification to Congress, that participation in the Institute is contrary to national security interests.

B. The bill provides that of the sum of the amounts authorized for Mathematical and Physical Sciences, Engineering, and Astronomical,

Atmospheric, Earth and Ocean Sciences, the Director of the Foundation is authorized to transfer up to $9 million to Ocean Drilling Programs for the Ocean Margin Drilling subactivity. The transfer may be made only after the Director has notified in writing the Speaker of the House, the President of the Senate, the House Committee on Science and Technology and the Senate Committee on Labor and Human Resources, and 30 days have passed without objection from either committee.

C. The bill amends the National Science Foundation Act of 1950 to provide greater flexibility in establishing special commissions by the National Science Board and in providing membership for such commissions. The bill also repeals section 6 of Public Law 95–99 regarding National Resource Centers, the codification considered is redundant and unnecessary.

D. Two additional amendments were made: (1) to repeal the National Science Foundation Organic Act a disclosure regulation now superseded by broader provisions and requirements of the Ethics in Government Act; (2) to repeal the National Science Foundation Act for fiscal year 1978 provisions banning NSF employees from owning patents on inventions resulting from NSF work. NSF does no in-house research and the provisions have never been needed.

E. Additional concerns and views of the Committee are reflected in the sections of this report on views and programs.

NATIONAL SCIENCE FOUNDATION BUDGET COMPARISONS—ACTIONS BY THE COMMITTEE ON SCIENCE AND TECHNOLOGY, NATIONAL SCIENCE FOUNDATION

[Authorizations in millions of dollars]

Activities	Current, fiscal year 1982	Administration request, fiscal year 1983	Committee recommendations (H.R. 5840)	Change from administration proposal
Mathematic and physical sciences	272.9	298.7	288.3	−10.4
Engineering	92.0	99.7	98.6	−1.1
Biological, behavioral and social sciences	176.0	186.7	201.0	+14.3
Astronomical, atmospheric, Earth and ocean sciences	240.0	259.7	250.8	−8.9
Ocean drilling programs	20.0	14.0	14.0	0
U.S. Antarctic program	66.0	86.4	86.4	0
Scientific, technological and international affairs	40.3	44.0	50.1	+6.1
Cross-directorate programs	0	0	0	0
Program development and management	63.5	63.1	63.1	0
Total, research and related activities	970.7	1,052.3	1,052.3	0
Science and engineering education	20.9	15.0	45.0	+30.0
Special foreign currency	4.6	2.2	2.2	0
Total, NSF	996.2	1,069.5	1,099.5	+30.0

II. Committee Views on Programs and Policies

1. SCIENCE AND ENGINEERING EDUCATION

Committee View

The Committee is deeply concerned about the continued deterioration of the nation's science and engineering education programs. Many witnesses have described the serious consequences to our economic strength and national security if this problem is ignored by the National Science Foundation.

There is a growing shortage of undergraduate faculty in engineering, laboratories are seriously outdated, and the quality of instruction is suffering. There is a severe shortage of trained math and science teachers in elementary and secondary schools.

This crisis occurs at a time when the United States is falling further behind other nations in several crucial fields of science and engineering that are directly related to our economic recovery and competitive technological position in the world.

In FY 1983 the Foundation proposes termination of all remaining science and engineering education activities except graduate fellowships. The Committee regrets this decision and believes that science and engineering education must remain a priority mission of the National Science Foundation as mandated in its charter.

Therefore, the Committee requests the Foundation to prepare a report and plan of implementation for a new comprehensive science education program designed to address effectively the nation's needs for excellence in science, mathematics and engineering education. This report should consider the full continuum of education—precollege, undergraduate and graduate. It should also include consideration of precollege faculty development; instructional facilities and equipment; and research in science and mathematics education and undergraduate instruction. The report should be provided to the Committee by October 15, 1982.

Furthermore, the Committee has recommended the addition of $30.0 million to the science and engineering education programs of the Foundation for a total of $45.0 million in this activity. It is the Committee's view that the additional funds be spent for precollege, undergraduate, and public understanding and research in science and engineering education programs. The remaining $15.0 million are to be allocated to graduate fellowships as requested by the Administration.

Finally, the Committee is disappointed to note that the Foundation has announced its intention to downgrade the organizational level of education activities from a full directorate to that of an office reporting to the Director. This action is being taken despite policy recommendations reiterating the key role of education functions in the Foundation noted most recently by the National Science Board (NSB 81–324). It is the Committee's view that such action is much more than a simple organizational change. Such a change is of the utmost importance, constituting a fundamental alteration of the Foundation's mission as defined by its organic act. If implemented and allowed to stand it will send exactly the wrong message to state and local governments, public and private institutions, and industry and business as to the importance of science and engineering education. Therefore, the Committee has added language to require that the Directorate for Science and Engineering Education be established as a permanent organizational entity of the Foundation. Among other things, this action is intended to convey the Committee's concern for maintaining a long-range commitment to science and engineering education by the Foundation.

Discussion

Science and engineering education continues to be a focus of major concern in considering the Foundation's budget priorities in FY 1983.

The Committee report for FY 1982, H. Rpt. 97–34, stressed that elimination or severe reductions of the education programs was unwarranted and unwise. The Committee recognized that budget stress and changing educational conditions made appropriate a reorganization to emphasize the areas of highest priority, but that total dismantlement would be wasteful. Important continuing needs included: fellowships and traineeships; instructional equipment; precollege faculty training; precollege education; policy development and research; and general public education.

Though the House approved a FY 1982 authorization level of $35 million and an original appropriation level of $27.7 million, budget constraints reduced the final appropriation to $20.9 million. Most of this money ($15 million) was for graduate fellowships. The remainder has been designated for prior program commitments, as well as a new National Science Board initiative, the Commission on Precollege Education in Mathematics, Science and Technology. The request for FY 1983 is $15.0 million, all of which is requested for the graduate fellowship programs. No other programs are requested for funding.

Because of the concerns for science and engineering education the National Science Board in August, 1981 reiterated the position of the Foundation in a statement on these activities (NBS 81–324). Noting that the Foundation has specific responsibility under the National Science Foundation Act to "recommend and encourage . . . national policies for the promotion of . . . education in the sciences" and "to initiate and support . . . programs to strengthen . . . science education . . . at all levels", the National Science Board proposed a core of activities focused on scientific and engineering human resource needs. They determined priorities in 1) research level education, 2) identification of critical science and engineering education needs and 3) selected high-leverage activities. They stated:

> The National Science Foundation discharges a number of its responsibilities in science and engineering education through its research directorates and programs. However, effective implementation of the full range of these responsibilities requires a discrete organizational entity within NSF. Furthermore, a budget commensurate with the Foundation's overall mission and program integrity is a fundamental requirement for sustaining a vital science and engineering education effect.

In response to this policy statement, the Director of the Foundation, Dr. John Slaughter, proposed in an implementing plan (NSB 81–372) that two steps be taken: (1) the establishment of a special commission on precollege education and (2) support in selected "high leverage" areas. These included: materials and publications; recognition of excellence by teachers and students; interaction between science teachers and university and industry specialists; and regional resource centers.

Despite the concerns and directives of last year and despite more recent expressions of concern for science and engineering manpower and education needs, NSF announced, in February 1922, the elimination of the Science and Engineering Education Directorate and its replacement with an "Office of Scientific and Engineering Personnel

and Education." Aside from fellowship monies the major focus of the office will be on the activities of the new Commission initiative. No monies for any of the "high-leverage" areas were requested.

Testimony received by the Subcommittee on Science, Research and Technology focused special concerns on precollege education. In the past decade there has been an average decline of 64 to 78 percent in secondary school science and mathematics teachers. Of those newly employed science and math teachers in 1981 an average 50.2 percent were unqualified in these areas. Of those now teaching in elementary schools, 51 percent report no training for teaching science and 70 percent without any in-service training. The Administration has suggested that the NSF programs were ineffective and insufficient to deal with the magnitude of the problem. In particular, science and mathematics curriculum development programs were highly criticized. However, recent studies of over 45,000 students showed 13 percent improvement overall and 24 percent higher achievement scores for minority groups when new curricula developed by NSF sponsored programs were used. Following this and related testimony and following the Foundation's own recommendations and policy guidelines a more reasonable course of action would be to target support to the critical areas already identified and for which NSF programs have high leverage.

It is for this reason that the Committee is recommending emphasis on three priority areas in addition to the graduate fellowship program: (1) Precollege Education, to include programs in career improvement and regional resource centers; (2) Undergraduate Education, to include scholarships for Math/Science teachers, instructional instrumentation and instructional improvement; and (3) Public Understanding and Research, with emphasis in extrascholastic learning science and mathematics at the precollege level.

The Committee expects that the majority of the additional $30 million for science and engineering education will be spent for precollege education programs. This would include roughly $9 million for science and math teacher career improvement programs, roughly $2 million for the National Resource Centers program and roughly $5 million for an experimental nationwide program for recruitment and retention of quality math and science teachers.

Approximately $8.5 million would be allocated for undergraduate education and equipment, including roughly $1.5 million for scholarships, $4 million for instructional equipment and the remainder for instructional improvement programs including but not limited to the Comprehensive Assistance to Undergraduate Science Education program.

The remaining moneys should be spent on Research and Public Understanding programs at a level of roughly $5.5 million. The graduate fellowship program as requested at $15 million by the Administration does not go far enough in meeting the full needs of graduate education particularly in such high demand fields as computer science and engineering, electronics, chemical engineering and materials engineering. However, in view of the projected deficit in the federal budget, the Committee cannot recommend a further increase in this program at this time. The Committee recommends that the Foundation consider targeting its fellowship program to disciplines of greatest potential demand.

2. BEHAVIORAL, SOCIAL, AND INFORMATION SCIENCES

Committee View

The Committee recommends that funds for programs in the Social and Economic Sciences subactivity, in the Cognitive Science and Anthropology program elements, and in the Psychobiology subelement, be restored to their fiscal year 1980 levels. In addition, the Information Sciences subactivity should be increased to $6.5 million. This requires an increase of $18.2 million from the Administration request of $38.3 million. The total would then be $56.5 million in these areas. The Committee recommendation, for the Biological, Behavioral, and Social Sciences Directorate is $201 million.

It should be emphasized that the relatively large percentage increase in the behavioral and social sciences merely redresses the imbalance imposed in earlier budgets, by bringing funding back to the fiscal year 1980 level. Obviously, this still reflects a substantial decrease in constant dollars. Although adjustment for inflation is clearly warranted, fiscal constraints limit our ability to provide additional funding. These constraints also force a reduction in the amount requested by the Administration for the biological component of the Biological, Behavioral and Social Sciences Directorate. This is not a reflection of the program's quality, but a recognition that not all program needs can be accommodated.

It is not clear to the Committee why, of all the research programs, the behavioral and social sciences have been singled out for what appears to be unwarranted. The progress made in these fields is reflected by the widespread use of research findings in many areas of society. Government and private industry have both been beneficiaries of our improved understanding of processes underlying productivity, the effects of regulation, and the influence of environmental policy, to name but a few. The complexities of social systems are orders of magnitude greater than those of systems studied by physicists and chemists, and research is by the same degree more difficult. Our need for such research is therefore correspondingly increased. There is little doubt that the accelerating pace of technology is creating unprecedented strains in the fabric of society. It would be imprudent to reduce our ability to understand and deal with these phenomena, particularly at this time. The research conducted by behavioral and social scientists represents our best hope for such understanding, and must be maintained.

Discussion

The Behavioral, Social and Information Sciences program [1] occupied a good deal of the Committee's attention in the 1982 budget. The drastic reductions proposed in that budget, on the order of 70%, aroused general concern. Although these reductions were partially reversed, the decrease has remained substantial. Consequently, the very small increase in the 1983 budget over 1982 still leaves these programs approximately 35% below 1980 levels. This compares to concurrent increases of 18–32% in the other physical and biological sciences during the same time period.

[1] Division of Behavioral and Neural Sciences, Division of Social and Economic Sciences, and Division of Information Science and Technology.

It appears difficult to justify reductions of this magnitude. Certainly, no other disciplines within NSF have suffered as severely. Perhaps these events might be understandable if there were reason to believe that projects supported by the Behavioral and Social Sciences programs were of low quality. However, no suggestion that this might be the case has ever been presented by the Foundation. On the contrary, numerous witnesses have attested otherwise.

Testimony received during the authorization hearings emphasized several important areas supported by these programs. There is a strong need for continued support by NSF for the development and maintenance of longitudinal data bases. These data bases monitor topics such as family income dynamics and electoral behavioral over long periods of time. Data of this kind are essential for the understanding of the dynamics of complex societal processes such as economic productivity and recovery. The longer of these data bases run about 30 years. These collections are widely used by academia, industry, and government with much of their value deriving from their continuity over extended periods of time. Although a number of such data bases have been developed and approved, only a small fraction could be maintained under the Administration's recommended budget. In most cases, funds for new data collection would not be available. Such a hiatus would literally do irreparable damage during a critical period of economic change. For example, high priority studies such as the Panel study of Income Dynamics and the National Election Studies will be supported at minimal rather than optimal levels. The General Social Survey, which documents trends in a wide variety of social indicators, will not be supported at all.

Other testimony focused on the application of behavioral and economic research to problems of productivity in industry. It was pointed out that this critical area is under active investigation both here and abroad and such studies in particular need to be continued at this time. New studies to understand what determines private savings behavior, for example, are also of obvious importance. Funding from private sources for basic research in this important area is unavailable or extremely limited. At the level of support proposed by the Foundation for the social and behavioral sciences, such new initiatives would not be possible.

A particular example of an important area of American science which is extremely vulnerable to the loss of federal support is that of anthropology. The NSF Directorate of Biological, Behavioral and Social Sciences provides 95% of federal funds provided for university-based research in this field. Because of this heavy dependence by anthropologists on the Directorate, the Committee would urge that the Foundation act in accordance with its unique role and strive to increase dollar support to its FY 1980 level. Foundation officials have presented the Committee with examples of significant anthropological contributions. The Committee has reviewed relevant material provided by the Foundation and in December 1981 interviewed a number of Foundation supported anthropologists. It concludes that, in many areas, anthropological research makes a significant contribution to national well-being. This is especially true in the international arena. A central goal of anthropology is to understand the bases of different cultural and national thought and behavior processes, and anthro-

pological studies provide a means for more effectively understanding and communicating with other nations. In the context of United States aid to developing countries, the Committee recognizes the importance of appropriate technologies and development policies that are responsive to different environmental and economic and social conditions. Anthropological research, particularly in the areas of agricultural techniques, demography, and indigenous health care delivery, provides techniques which are appropriate in large parts of the developing world. The Committee also recognizes the crucial role which Foundation support has played in research on early man. It also realizes that many countries take great pride and interest in their anthropological heritage and believes that such research by United States scientists strengthens our international ties. It urges the Foundation to give serious consideration to the recommendations set out in its own 1979 report on this subject.

In summary, the restrictions imposed during the current fiscal year have had a significant negative effect on research in the behavioral and social sciences. Given that NSF is by far the most significant source of support for these disciplines, this could hardly be otherwise. One visible effect is the sharply reduced number of proposals in the past year with the perception that funding in this area is marginal. It seems clear that less empirical research will be done, with investigators focusing on less costly theoretical analysis. Much work of considerable promise will be terminated with such disruptions not easily reversible.

With regard to the Division of Information Science and Technology, this Division is the sole source of federal funding for the support of non-mission-oriented, investigator-initiated, and university-based support in the rapidly developing field of information science and technology. The improvement of the fundamental knowledge base concerning the organization and structure of information and processes of information transfer is essential to preserving national competitiveness in world markets, maintaining national security, and applying new knowledge to benefit society. Several Nobel Laureates and other scientists brought these concerns to the attention of the Committee and recommended increased funding for this NFS program.

Therefore, it is the Committee's view that the Foundation allocate up to $6.5 million to the Division of Information Science and Technology. This increase should be made available from funds allocated from the biological sciences rather than the behavioral and social sciences where less program growth has been realized.

3. WOMEN AND MINORITIES

Committee View

The Committee continues to support the Science and Technology Equal Opportunities Act in its purpose of increasing participation by women and minorities in science and technology. The efforts made by the Director of the Foundation, particularly in the area of minorities, are recognized by the Committee as strides forward in view of present budget constraints.

There is concern that programs to offer basic assistance to women scientists to begin independent research careers and be able to com-

pete successfully for regular research support are not being supported in the Foundation's FY 1983 budget request. The Visiting Professorships for Women program, while small, will allow greater visibility for women scientists and engineers. However, without the underlying, basic research support programs, many women will be unable to take advantage of the Visiting Professorships program. The Committee, therefore, has restored $3 million of the $5 million originally budgeted in response to the Equal Opportunities Act to start the National Research Opportunity Grants program, intended to fill this gap.

Discussion

Programs for Women and Minorities have not kept pace with the requirements and expectations of the Science and Technology Equal Opportunities Act (P.L. 96–516, December 12, 1980). That Act declares that "The highest quality science over the long-term requires substantial support, from currently available research and education funds, for increased participation in science and technology by women and minorities." The Act emphasized that all underrepresented groups should have an equal opportunity to participate in science and technology. It recognized barriers to women and minorities caused by the impact of the advance of science and technology. And it directed the National Science Foundation to support and initiate activities and programs to improve their access to and increase participation of women and minorities in science and technology.

Several new programs were initiated in the Cross Directorate area in response to the Act, but rescissions in the FY 1981 plan reduced them from $9 million to $1.4 million. The FY 1982 revised budget eliminated all Cross Directorate programs. However, the congressional budget process restored three of the programs for women and minorities to a level of $2.7 million. The table below shows the funding history of these programs which, in the FY 1982 budget have been included in the Coordinated Agency-Wide Research Activities (CARA) subactivity of Scientific, Technological and International Affairs (STIA).

[By fiscal years, millions of dollars]

	1981 plan	Actual after rescission	1982 plan	1983 request
National opportunity grants	5.0	0	0	0
Visiting professorships for women	1.0	0	.5	1.0
Minority research initiation	1.5	1.4	1.7	2.5
Research improvement in minority institutions	1.5	0	.5	2.0
Total	9.0	1.4	2.7	5.5

National Research Opportunity Grants (NROG) was established to assist women scientists to begin independent research careers, assist women scientists whose careers have been interrupted to re-enter the labor force, and increase the capability of women to compete successfully for regular research support from the Foundation and other funding sources. Since no funds had been requested in the FY 1981 budget, $5 million was reprogrammed from research activities to start the NROG program; later in the same year the entire amount was re-

scinded. The January FY 1982 NSF budget requested $5 million for the program but it was eliminated in the March budget revision and was not requested in the FY 1983 budget. The Committee feels it is important that this program be implemented and therefore suggests that some funds be restored.

Visiting Professorships for Women in Science and Engineering is intended to provide greater opportunities for industry-university interaction for women scientists and engineers employed in industry and government or in academic research. In FY 1982 this new program was funded at $500,000. Program announcements have gone out and 8 to 12 awards are expected for this year. The usual award will be for 12 months, although periods of 12–24 months will be considered. In FY 1983, requested at $1 million, the program will be able to double the number of grants.

Minority Research Initiation (MRI) was established, at $1.5 million, in response to Public Law 96–516, to increase the participation of minority scientists in research careers by providing support funds for individual faculty of minority extraction who have full-time status in any college or university in the United States. The program was reduced $100,000 by the FY 1981 rescissions. MRI was requested at $1.5 million in the FY 1982 budget, but eliminated in the March budget revision. At that time it was stated by NSF that "Foundation programs that are narrowly focused on individual groups or subsets of institutions will not be continued in FY 1982."

This policy was also responsible for the termination in the revised FY 1982 budget of the program Research Improvement in Minority Institutions (RIMI). This program sought to assist predominantly minority colleges and universities to establish active research programs on their campuses. Although not separately identified, RIMI had been for several years part of the Foundation's efforts to provide greater access to scientific careers by minorities. The program had been requested in Cross-Directorate programs in FY 1981 at a level of $1 million with an added emphasis in response to Public Law 96–516 raising it to a level of $1.5 million, all of which was wiped out by the FY 1981 rescissions. The FY 1982 request of $1.5 million was eliminated by the March budget revision.

Through House restorations the two minority programs were funded for FY 1982 at $1.7 million for Minority Research Initiation and at $.5 million for Research Improvement in Minority Institutions. The Committee recognizes the NSF requested levels for FY 1983 for these two programs, at $2.5 million and $2 million, respectively, as an improvement. It is hoped that continued emphasis on these programs to implement the Science and Technology Equal Opportunities Act will be an important thrust of the Foundation.

4. RESEARCH INSTRUMENTATION

Committee View

The Committee recognizes that current budgetary stress does not permit a level of funding commensurate with the magnitude of the research instrumentation problem. Indeed, by any standards, the approximate 6 percent increase over FY 1981 funding for research

instrumentation is quite inadequate. However, the Foundation initiation of a study of existing facilities, as well as its organization of an Interagency Working Group, does reflect an attempt to come to grips with the problem.

The Committee would like to express once again its desire to obtain some "benchmark" estimates against which to evaluate the magnitude of the instrumentation shortfall. The analysis underlying such estimates should be clearly visible. Although it is quite clear than any evaluation of this kind will contain inaccuracies, it is necessary to illuminate the complex issues which underly the development of this problem.

It is the Committee's view that, in the absence of any further information, the Foundation commitment of $95.3 million in FY 1983 is reasonably appropriate. Nevertheless, to insure that these funds are not inadvertently rebudgeted for other purposes, the Committee directs that no less than 10 percent of the funds for the Mathematical and Physical Sciences; Engineering; and Astronomical, Atmospheric, Earth, and Ocean Sciences Directorates be targeted for research instrumentation.

Discussion

As in previous years, the shortage of research instrumentation in the nation's universities was singled out as a matter for particular concern. Progress in modern science is dependent on the availability of state-of-the-art instrumentation. In his opening remarks, the Committee Chairman pointed out that the problem was recognized as being serious in an NSF report released in1972. In the ten years since that time, matters have become progressively worse. Absent a directed and substantial effort to remedy the situation, only further deterioration can be expected.

Neither the Foundation spokesman nor the outside witnesses denied the gravity of the situation. Dr. Donald N. Langenberg, Deputy Director of the National Science Foundation, cited in his testimony a shortfall of $1 to $4 billion. Although this number was not seriously challenged, there was no explanation of how it was obtained. Consequently, the Committee has no means of judging the degree to which the Foundation commitment of $95.3 million meets existing needs. Furthermore, there is not one instrumentation problem, but several. Needs for the upgrading of national resources must be distinguished from the availability of research equipment in individual laboratories. The budget document provides only limited information on this point. Finally, it is clear that NSF cannot and should not be considered the only source of support for instrumentation within the Federal funding agencies. Some active coordination with other agencies is underway, but the fruits of this effort are not apparent.

During a period of fiscal stringency, a problem of this magnitude cannot be solved overnight. A program to approach a solution is required. The NSF, as custodians of the basic research effort in this country, has the responsibility to provide such a program. The patchwork, ad hoc funding mechanisms within NSF, and the meager coordination between Federal agencies, do not inspire confidence that progress is being made. Given that the problem has been visible for so

many years, the Committee wishes to express its concern that no such program has been forthcoming.

Finally, the Committee would like to be assured that funds allocated in individual grants for instrumentation are expended in a manner consistent with the intent of the award. Although some flexibility in the disposition of funds is necessary, limited post-award monitoring leaves open the possibility of an applicant repeatedly demonstrating a need for equipment, and diverting the funds to other, grant-related, purposes. If Congress is going to be asked to approve a budget which includes money earmarked for instrumentation, it seems reasonable that some mechanism be established to assure that the funds are used for that purpose. In particular, it is necessary to focus attention on renewal proposal procedures in monitoring such expenditures.

5. INTERNATIONAL COOPERATION IN SCIENCE

Committee Views

The Committee continues to maintain its strong support for the programs fostering the international exchange of scientific and technological information and international scientific cooperation particularly in Western Europe, Japan, China, and developing countries. The Committee feels a balanced cooperative program should be maintained with the industrialized nations and the developing countries, again emphasizing such programs in Latin America and the Caribbean.

Of the additional monies provided to the Directorate for Scientific, Technological, and International Affairs, $1.6 million is authorized to the international programs. That money is specifically intended to maintain continued U.S. participation in the International Institute for Applied Systems Analysis under the special conditions discussed below.

Discussion

The Foundation's international activities are conducted within the Science, Technology and International Affairs directorate (STIA). In previous years those activities had been subdivided as international cooperative programs (bilateral and regional), international scientific organizations and travel. Since funding for the latter two subelements has been eliminated, the budget reflects only geographical cooperative programs (Europe, Asia, Africa and Latin America). The request of $9.1 million for FY 1983 represents a 14.2% overall decrease from FY 1982 spending.

Two issues have been of particular concern to the Committee in considering the appropriation's request for FY 1983 for international cooperative activities. These are the elimination of funding for U.S. membership in the International Institute for Applied Systems Analysis (IIASA) and the growing debate regarding national security and scientific exchange.

International Institute for Applied Systems Analysis (IIASA).—The Administration has taken the position that the International Institute for Applied Systems Analysis should not be funded based on arguments of (1) other funding priorities, (2) lack of reciprocity, (3) poor quality of research, and (4) national security. The Committee notes that with regard to the first three concerns (funding priorities, reciprocity and quality) the administration is presenting the same arguments as in the last fiscal year request, arguments that were

rejected by the House Authorization and Appropriations Committees. The committee must again disagree with the administration's premises.

IIASA has been evaluated more often and more thoroughly than perhaps any other international science program. The research efforts being carried out in such areas as energy, environment, food, and natural resources are of global importance and significance. In a budget which allocates over $86 million for maintaining a U.S. "presence" in a remote area such as the Antarctic, it does not seem conceivable that funding cannot be found for maintaining a U.S. "presence" in the only multilateral, multi-purpose scientific research institute of its kind in the world. This is particularly true given the reduced dues structure being offered to the U.S. in response to its expressed budgetary concerns.

With regard to the quality of research, it should be pointed out that the Foundation, in reports as recent as two years ago, noted that the research being conducted was of the highest quality with notable results in the development of new analytical methods. More recently the National Academy of Sciences considered the results of the Institutes programs and concluded that IIASA is "a unique and valuable instrument for international scientific cooperation which produced research of excellent quality and has contributed significantly to better understanding of major global issues".

Regarding the argument of reciprocity, it must be noted that the U.S. is only one member in a 17 member organization including many European countries and Japan. Unlike bilateral science agreements with the Soviet Union, it is not reasonable to expect that U.S. scientific contributions must result in a one-to-one, demonstrable scientific "return." In fact, in an organization such as the Institute it can never be discernable which among the 17 member countries provides what scientific inputs to a given analytical process. Rather, the most useful results come from the interaction and synthesis of new ideas resulting from bringing many points of view and varied experience to the analytical processes.

With regard to a verified and documented question of national security the Committee has sought to carefully assess the position of the administration. National security, while of concern and of critical importance to all, is recognized as a prime responsibility of the President. Because the Administration has occasionally suggested that there might be concern for national security in maintaining U.S. membership in IIASA, the Committee has specified that the additional $1.6 million made available for IIASA as part of the International activities of the Directorate for Scientific, Technological and International Affairs (STIA) would not be authorized should the President make a final determination that continued participation would be detrimental to national security and that Congress is notified formally of that determination.

At this point, however, it is not clear that all the evidence has been fully evaluated or that current facts support the hypothesis of a security problem at the Institute. Testimony by Dr. Thomas Malone, the Foreign Secretary of the National Academy of Sciences stated: "We have examined (the national security issue) in detail now, through looking at classified documents by a panel which has been

cleared and do not find that (argument) persuasive." More recently, Dr. Frank Press noted in communication to the committee dated March 5, 1982, the National Academy's conclusion that "continued U.S. participation in IIASA is not inconsistent with national security." The IIASA Director noted to the Academy specific steps taken at IIASA to meet concerns for possible security issues raised in the past.

Should the funds made available for IIASA not be expended for that purpose, the Committee expects that the $1.6 million be used in the remaining international programs of STIA.

National Security and Scientific Exchanges.—Recent statements by the Administration (F. Carlucci, Deputy Secretary of Defense; Adm. R. Inman, Deputy Director, CIA) have indicated a growing desire to control and censor international scientific exchanges/publications. Adm. Inman suggested that there currently existed a "Hemorrhage of the country's technology" and steps would be taken to inhibit that flow—either voluntarily or by law or both. Apparently such thinking has colored decisions regarding IIASA and other scientific exchange programs with the Soviets and the Eastern European countries. As noted by Dr. William Carey in testimony before the Committee, "there is not a peace time precedent for generalized prior restraint on open and unclassified scientific research." He went to say:

> I am deeply concerned that even without Congressional action we will see progressively tighter government controls imposed on scientific communication both domestically and internationally through the export control and the executive order routes. I think the consequences would be to suffocate the best science through intimidation, red tape and uncertainty, and deny the United States the payoffs that result from high quality interactive research.

6. INTERGOVERNMENTAL PROGRAMS

Committee View

The NSF Intergovernmental Program has sponsored an impressive array of projects throughout the country aimed at improving the productivity and increasing the efficiency and effectiveness of State and local governments through the application of science and technology. Many projects conducted by the State and regional innovation groups return savings to the taxpayer that demonstrably exceed the small amount of federal support they receive. Such programs have been particularly effective for small business innovation in the northeastern section of the U.S. These points were reemphasized by the Task Force on Technological Innovation held at the 1982 meeting of the National Governor's Association. As in the past there was a call for sustained, long-term commitment by the Federal Government to support intergovernmental science and technology.

The Committee directs that no less than 1.5 million dollars be made available to the Intergovernmental Program to help achieve the institutionalization of the projects underway. Given the current economic circumstances, it is important to keep in place mechanisms which help local and state governments to reduce costs and improve service delivery. More significantly, the improved management of the state and local governments that result from these efforts is most im-

portant at a time when the Federal Government is shifting responsibilities to those levels of government, particularly with the emphasis on "new federalism."

Projects in this program area must be highly focussed and supported at levels which can optimize the likelihood of a successful outcome. At the level provided in the 1983 budget, it is more likely that funds will be insufficient to successfully implement any specific programs, and that the dollars will be spent for relatively unproductive purposes. It is the Committee's opinion that the support level of $0.5 million is insufficient, and that some increases are required to allow the program to function properly. Specifically, the Committee recommends that emphasis be placed on supporting the establishment and functioning of statewide, regional, and national innovation networks. These structures have strong ties to the small business community, as well as to regional governments. Contributing to their efforts would also reflect the interest of Congress in technology transfer, as exhibited in the Stevenson-Wydler Act of 1980, and in aiding small businesses, as seen in the pending Small Business Innovation Development Act. The Committee recommends, also, that funding be provided to the federal laboratory Consortium for Technology Transfer.

Discussion

The Intergovernmental Program of NSF is primarily designed to aid state and local governments in utilizing scientific and technological tools. Previous functions, which have been eliminated, included public service activities such as Science for Citizens and Appropriate Technology.

Last year, the Committee expressed concern over plans to terminate programs in mid-course before they were able to become independent of federal money. The committee felt that "termination of assistance before the course of planned evolution from federal assistance has taken place would simply waste initial funds".

Unfortunately, the National Science Foundation request provides only $500,000 in FY 1983 for the Intergovernmental Programs. Because of this reduction, the survival of many of the projects is in question. This is true even though these programs have made substantial progress since last year in developing a diversified funding base. For example, the regional innovation groups have merged their efforts into a single national approach to develop a diversified financial strategy which allows the private sector to support what has been up to now an essentially public sector function. These groups have raised money from local governments to retain professional expertise to accelerate the privatization process. Evidence to date indicates that the private sector prefers a partnership in which it shares the cost of these programs with the Federal Government. The efforts of the regional innovation groups are now in jeopardy due to the reduction in funding from NSF.

At the state level, the Foundation has an impressive record of supporting projects in the Executive and Legislative Branches that become fully funded by the States after the typically three-year demonstration period ends and federal monies cease. There are about two dozen programs in the states currently funded by NSF which are directed toward strengthening the capacity of Governors and legislative leaders to better address the problems and issues they face that have

scientific and technical aspects. These efforts are being cut short prematurely by the severe reduction in funds and, because they have not had the time to demonstrate their effectiveness, may not become institutionalized and fully supported by State funds.

Technology transfer is widely recognized as a cost-effective approach to the utilization of resources provided by modern science and technology. Implementation of such activities is clearly of value. Consequently, the 90% decrease in funding of this program since fiscal year 1980 is viewed with some alarm. Although fiscal stringencies may require some reductions, it must be questioned whether the token amount remaining is of any value at all.

7. RESEARCH TO AID THE HANDICAPPED

The Committee directs the Foundation to reestablish the Science and Technology to Aid the Handicapped Program which was zeroed out of the FY 1983 budget. The original program (formerly in the Applied Sciences and Research Applications Directorate, was authorized in FY 1979 for $2 million. In FY 1980, the Committee recommended expanding the program and requested an increase of $1 million over the $1.8 million funding requested by the Foundation, to a total of $2.8 million. In 1981, the S & T to Aid the Handicapped Program was located in the Electrical, Computer and Systems subactivity of the Engineering Directorate at a reduced funding level of $1.6 million. The current plan for FY 1982 shows a further decrease to $600,000, and finally zero funding for 1983.

The Committee believes that many of the problems confronting an estimated 35 million disabled Americans could be alleviated by our scientific and technical resources. The Foundation, with access to the full spectrum of science, in a unique position to influence the development of technical solutions to debilitating handicaps.

Accordingly, the Committee authorizes that no less than $2 million be appropriated for the program of Science and Technology to Aid the Handicapped and that this program be restored to its former position.

The Small Business Innovation program is also well-suited to the development, transfer, and ultimate utilization of technology for the handicapped. The Committee expects the research and development to aid the handicapped component of this program to continue at a viable level.

8. GEOGRAPHIC DISTRIBUTION

The Foundation has a statutory obligation to avoid undue concentration of its grant distribution. The Committee strongly endorses the Foundation's Experimental Program to Stimulate Competitive Research in States. The Committee feels that the relatively small investment in resources targeted for this program is more than balanced by building a broader base for scientific achievement in this country. It is also essential to make clear to the nation that the Foundation is dedicated to ensuring that historical accident and patterns of the past will not be allowed to lock in an unequal geographic distribution of research support. The bill plans an increase for this program of $500,000 which will restore it to $3.0 million, its FY 1982 level of funding.

Discussion

The awarding of research grants on the basis of quality of technical merit insures that only first-rate research will be supported, but tends to perpetuate the uneven distribution of research capability. To avoid undue concentration, and to increase the nation's overall research potential, it is necessary to improve science education and research capabilities in areas and institutions that desire to become more competitive. Clearly, a separate development program is needed, with its own special criteria for selecting development award recipients. The authorization for Coordinated Across Research Activities (CARA) programs in the Scientific, Technological and International Affairs Directorate, reflects a conviction that the special development program should not be cut, as proposed by the Administration, but should be maintained at its FY 1982 level.

9. THE NATIONAL SUPERCONDUCTING CYCLOTRON LABORATORY

Committee View

There has been, for many years, a division of responsibility between the Department of Energy and the National Science Foundation for funding of projects in nuclear physics. The division has not been defined in a particularly clear manner, but as long as strong interagency communication and coordination is maintained the system appears to work well.

For fiscal 1983, the construction funds for the National Superconducting Cyclotron Laboratory (NSCL) at Michigan State University have been transferred by OMB from the Department of Energy to the NSF budget request. The funds involved are $6.8 million. Despite modest adjustments by the Committee in the overall figure for the NSF Directorate of Mathematical and Physical Sciences, the Committee wishes to make it clear that it intends the funding for the NSCL to remain intact at the $6.8 million figure requested by the Administration.

10. THE NEED FOR BASIC EXAMINATION OF THE SCIENCE AND TECHNOLOGY SUPPORT SYSTEM

The Committee has been concerned with many individual issues related to the nation's research support system—instrumentation, graduate fellowships, faculty retention, strength of the national laboratories, geographical distribution, incentives for industrial research, etc. The breadth, number and persistence of individual issues suggest, however, that these may be only individual symptoms of much more fundamental problems.

The budget stress of the last two years has raised some of these symptoms to acute levels, but many have been developing for several years. Some, like maintaining high quality modern instruments in university laboratories, may be related directly to gaps in the research support system. Others, such as the dramatic rise in the fraction of non-U.S. students and faculty in engineering schools, may be products of much broader social and economic trends. Whether arising directly from the structure of the research community or not, however, these broad trends will have to be faced by the American university and science and technology communities. As just one example, the large demographic

shifts occurring in our country, both in geographical and age distribution, may suggest the need for a sharp change in university teaching emphasis, perhaps toward continuing education and retraining instead of providing a single initial academic experience.

The external social and economic factors are only a few of the parameters of our research system which have been changing since its original design took shape in the post-World War II years. The complexity of governmental organization, and the number and diversity of outside performers of research, have also grown dramatically. Many federal and state agencies now have missions strongly dependent on science and technology, and many of the needed research agendas are interdisciplinary and interwoven with developments in other mission areas. Thus, the coordination and dissemination of research results can be as important as providing for the initial support. As the government has emerged as a leading performer or suporter of both basic and applied research, a host of questions has also arisen as to the proper mechanisms to balance research investment targeted to identified national needs against the more market demand or opportunity oriented systems of allocating research resources.

The Science Advisor to the President has stressed a response to current budget limits involving more attention to priority-setting among research areas. Others have emphasized the need to more clearly link research investment to national or local problems or opportunities. The importance of building stronger incentives for change, renewal, and responsiveness to unforeseen technical opportunities is often stressed in discussing the research system. It is not at all clear that the basic grant and contracting system that has been built up in the three decades since the famous Bush report, "Science the Endless Frontier," is the ideal system to meet the concerns and constraints of the future.

Therefore, the Committee strongly, values efforts within the science and technology community to fundamentally analyze these basic structures and procedures, with a goal either of re-affirmation or of developing a mandate for change. The National Academy of Sciences' October 1981 meeting on the implication of long-range budget stress on the vitality of science in this country was an important step of this kind. The continuing examination of those questions by the Academy's Committee on Science, Engineering and Public Policy is a welcome follow-up to the October initiatives, and the Science and Technology Committee will want to keep in close touch with the findings and ideas of the Academy group. Other initiatives of representative scientific and engineering bodies to examine new ways to approach fundamental issues in maintaining a world leadership position for U.S. science and technology will similarly be extremely helpful to the Committee in carrying out its Congressional policy-making and budget oversight role. The Committee assumes also that both the Foundation and the National Science Board will be responsive to such initiatives, and it will want to work closely with their leadership in bringing new approaches into long-range budget and program planning.

III. Additional Views

ADDITIONAL VIEWS OF CONGRESSMAN GEORGE E. BROWN, JR., ON THE NATIONAL SCIENCE FOUNDATION FISCAL YEAR 1983 AUTHORIZATION BILL

I would like to express my support for the actions taken by the Science and Technology Committee with regard to the National Science Foundation Authorization Bill for FY '83. I think that a strong case could be made for growth in the overall program, but I am satisfied that the Committee has at least maintained a level budget as compared to FY '81 dollar figures. Last year I objected strongly to the severe cuts proposed by the Administration, specifically in the areas of the biological, social and economic sciences, science education, and civilian R&D. Some of the same objections can be made this year but I am pleased that the Committee has acted to restore some balance to the Foundation's programs.

The cuts in the Science Education proposed by the Foundation are particularly alarming in view of the steady decline in this Directorate over the last years. I will not reiterate here the well known need and advantage of a scientifically literate population in this country but will only point out that our competitors internationally are giving us a "run for our money". This is due to diverse factors, but can be attributed in part to the lack of an adequate scientifically literate population. I fully support the Committee's action in restoring funding for education programs for precollege, undergraduate, and public science and engineering education. I also firmly believe that the Foundation ought to actively maintain its commitment to education activities. Unfortunately, the cuts already made are having the debilitating effect we feared.

I am also pleased that the Committee has again rejected the Administration's proposal to terminate our participation in the International Institute for Applied Systems Analysis (IIASA). The Committee views thoroughly document the importance of continuing our participation. The Administration's position on this issue is only one part of an overall attempt to restrict scientific exchange in an ill-conceived attempt to protect ourselves on the international scientific front. Restrictions of the type proposed would have important ramifications on scientific exchange between scientists in our own country and affect the public understanding and awareness of what goes on in scientific research and its importance to innovation and productivity. Ultimately this will only serve to aggravate international trade problems we are already experiencing and hamper scientific innovation and growth.

In closing, I would like to say that what I regret most in this year's Committee action is the unfortunate politicization of the National Science Foundation's budget consideration by the Reagan Administration and its adherents. This is a new phenomenon for our Committee which I sincerely hope is short-lived. The activities of the National Science Foundation are too important for the nation to be reduced to political rhetoric.

George E. Brown, Jr.

MINORITY VIEWS—NATIONAL SCIENCE FOUNDATION AUTHORIZATION BILL

The Minority Members of the Science and Technology Committee find it necessary, for the second year in a row, to oppose the Committee's budget level for the National Science Foundation. While our position this year again puts us in the role of seeking a reduction in science R. & D. budget projections, we do not see ourselves as unmeditated budget cutters. In an era of fiscal restraint, it is much easier to establish budget levels at arbitrarily higher figures than Administration requests than to try to develop budgets within certain constraints. Under this scenario, the Minority will always appear as cutting the science budget since the Majority will always set higher levels than those presented by the Administration. To translate this inevitable situation into political rhetoric, labeling Republicans as unsupportive of the sciences, denies our unanimous support of the Foundation's mandate and the majority of its programs.

Despite our desire to remain at precisely the Administration's budget request of $1.0695 billion, the critical need for improved science education led us to offer an alternative NSF budget of $1.085 billion. Our alternative budget targeted $5 million over what the Majority's budget offered for science education, yet remained almost $15 million below their total budget figure.

There is agreement on both sides of the aisle on the vast majority of the Foundation's program. Most of our differences are minor, reflecting slightly different priorities in how NSF's research endeavors ought to be carried out. Specific areas of agreement include science education, research instrumentation, the mathematical, physical, and engineering sciences.

Where we take great issue is in the area of international programs and national security questions. The Committee views go to some length on these points so it is only appropriate that the Minority respond.

The Minority supported efforts to eliminate funding for a specific program in the NSF international affairs element. We, in effect, agree with the Administration's proposed withdrawal from the International Institute for Applied Systems Analysis (IIASA) for several reasons.

First, from the point of scientific benefit to the United States, IIASA does not compete favorably with other international programs of the National Science Foundation. Higher priority is assigned to NSF's bilateral programs with Japan, Western Europe, China, Mexico, Brazil, Korea, India, Israel, Egypt and other developing countries. Secondly, and this perhaps is most important, there has been no East/West reciprocity in IIASA programs. The Soviets and East Europeans have used IIASA to obtain access to Western scientists, computer techniques, and data bases—beyond what normally

would be approved on a bilateral basis—without providing anything comparable in return.

For example, there is not a single useful Soviet data contribution to IIASA's energy studies. The whole description of Soviet and East European energy outlooks in that study is therefore suspect, starting with the assumption that these economies are going to grow one to one and one-half percent a year faster over the next fifty years than U.S. and Western European economies. In general, while IIASA's computers have plugged into a great many Western European technical data bases, the Soviets and East Europeans have not made a single comparable data base available.

Third, the Soviets have misused the institute for intelligence purposes. Last April, IIASA's secretary for external relations, a traditional Soviet position at IIASA, was exposed by Norwegian intelligence as a KGB agent. From the point of view of the KGB, IIASA is an ideal vehicle for scientific cooperation with the West. IIASA provides them access to technology of high interest in an open environment where people are eager to share their knowledge.

Our Western allies are not opposed to our withdrawal, and we think it is appropriate action to take.

Regarding the national security questions raised in relation to scientific research and exchanges, we feel the Committee is over reacting to statements made by Admiral Inman, Deputy Director of the CIA. He has made it quite clear that he is not advocating a cut in the flow of scientific information, but rather some voluntary efforts *within* the scientific community to substantially lower the risk of sensitive material falling into enemy hands. His suggestions make a great deal of sense, especially in light of successful efforts in the field of cryptology.

In conclusion, the Minority finds a great deal to agree with in the Committee views. We simply preferred our budget priorities of spending more for science education while spending less overall. We also support the Administration's efforts to withdraw from IIASA and feel that the Majority has simply over reacted to comments from the Administration on national security concerns associated with university research programs.

We continue to support a strong and vibrant scientific enterprise in the National Science Foundation and within the nation's colleges and universities. We look forward to the continuing dialogue on these issues.

LARRY WINN, Jr.
HAMILTON FISH, Jr.
MANUEL LUJAN, Jr.
ROBERT S. WALKER.
EDWIN B. FORSYTHE.
WILLIAM CARNEY.
MARGARET M. HECKLER.
F. JAMES SENSENBRENNER, Jr.
VIN WEBER.
JUDD GREGG.
JOE SKEEN.

IV. Explanation of Committee Amendments

1. On page 4, after line 17, add a new subsection to read:

(D) Of the amounts authorized to be appropriated under Section 201(7), for Scientific, Technological, and International Affairs, no amount is authorized to be available for United States support of the International Institute for Applied Systems Analysis in Vienna, Austria, providing there is a final determination by the President, and notification to the Congress, that participation in the Institute is contrary to national security interests.

EXPLANATION

The International Institute of Applied Systems Analysis (IIASA) is a multinational nongovernmental organization located in Vienna, Austria. The Institute, through its 17 member nations, acts as a coordinating organization for international study on issues such as global energy and agriculture. The U.S. contribution to the support of IIASA comes from the NSF International Cooperative Scientific Activities Program, and is expected to be $1.6 million in FY 1983.

The Committee's budget includes funding for the Institute. However, as stipulated in the amendment this authorization for funding would be removed should there be a determination by the President and notification to Congress that participation was contrary to national security interest.

2. On page 7 line 21, insert two new subsection (c) and (d) to read:

(c) Section 10 of Public Law 95-~~99~~, the National Science Foundation Authorization Act for FY 1978, is repealed.

(d) Subsection 12(b) of the National Science Foundation Act of 1950, as amended, is repealed and the preceding subsection is redesigned by striking the "(a)".

EXPLANATION

Subsection (c): repeals the disclosure regulation now superceded by broader provisions and requirements of the Ethics in Government Act.

Subsection (d) repeals provisions banning NSF employees from owning patents on any invention resulting from NSF related work; the provision is considered unnecessary as no in-house research is conducted by NSF and there has been no use of the provisions since 1950.

No increase in cost or personnel will result if the proposal is enacted.

V. Changes in Existing Law Made by the Bill, as Reported

In compliance with clause 3 of rule XIII of the Rules of the House of Representatives, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is printed in italic, existing law in which no change is proposed is shown in roman):

NATIONAL SCIENCE FOUNDATION ACT OF 1950

SPECIAL COMMISSIONS (42 U.S.C. 1868)

SEC. 9 [(a) Each special commission established pursuant to section 4(h) shall consist of eleven members appointed by the Board, six of whom shall be eminent scientists and five of whom shall be persons other than scientists. Each special commission shall choose its own chairman and vice chairman.

(b) It shall be the duty of each such special commission to make a comprehensive survey of research, both public and private, being carried on in its field, and to formulate and recommend to the Foundation at the earliest practicable date an overall research program in its field.]

(a) Each special commission established under section 4(h) shall be appointed by the Board and shall consist of such members as the Board considers appropriate.

(b) Special commissions may be established to study and make recommendations to the Foundation on issues relating to research and education in science and engineering.

[RESOURCE CENTER FOR SCIENCE AND ENGINEERING (42 U.S.C. § 1884)

(a) The National Science Foundation shall establish a Resource Center for Science and Engineering to be located at an educational institution which—

(1) enrolls substantial numbers of minority students, students from low-income families, or both;

(2) is geographically located near one or more population centers of low-income families or minority groups;

(3) demonstrates a commitment to encouraging and assisting minority students or students from low-income families, or both; and

(4) has an existing or developing capacity to offer doctoral programs in science and engineering.

(b) The Center established under this section shall—

(1) support basic research and the acquisition of necessary research facilities and equipment;

(2) serve as a regional resource in science and engineering for the community which the Center serves; and

(3) develop joint educational programs with nearby pre-college and undergraduate institutions which enroll a substantial number of minority students or students from low-income families. (Section 6 of P.L. 95–99).]

[FINANCIAL INTEREST-ACADEMIC AFFILIATION DISCLOSURE (42 U.S.C. § 1873a)

(a) (1) Each officer or employee of the National Science Foundation who performs a decisionmaking function in the handling of any application or proposal for a grant from or contract with the Foundation shall provide a written statement for the record identifying (in

accordance with the standards promulgated under subsection (b)) any financial interest or other relevant interest he or she has in the person submitting the application or proposal and any academic affiliation he or she has with that person. If the application or proposal results in an award, the statement shall be made available to the public.

(2) The Director shall remove or take other appropriate disciplinary action against any employee who knowingly violates the requirements of this subsection.

(b)(1) Within 60 days after the date of the enactment of this Act, the Director of the National Science Foundation shall publish—

(A) proposed standards to implement the requirements of subsection (a), designed to minimize conflicts of interest and to assure that the appropriate files of the Foundation relating to any grant or contract referred to in such subsection contain a statement of any financial or other relevant interest which any of the officers and employees involved may have in the person or institution applying for or proposing the grant or contract as well as any academic affiliation which any of such officers and employees may have with such person or institution; and

(B) proposed standards appropriately requiring identification of any conflicts of interest by peer reviewers.

(2) Within 120 days after the date of the enactment of this Act, the Director shall promulgate the standards published under paragraph (1), with such modifications as the Director may deem appropriate; and such standards shall take effect up on their promulgation.

(c) The Director shall report annually to the Congress on the administration and enforcement of this section.

(d) If the President issues an Executive order that requires financial disclosure by officers and employees of Federal agencies generally, only so much of this section as relates to peer reviewers and to academic affiliates of officers and employees shall remain effective. (Section 10 of P.L. 95–99)]

PARENT RIGHTS (42 U.S.C. § 1871)

[SEC. 12. (a) Each contract or other arrangement executed pursuant to this Act which relates to scientific research shall contain provisions governing the disposition of inventions produced thereunder in a manner calculated to protect the public interest and the equities of the individual or organization with which the contract or other arrangement is executed: *Provided, however*, That nothing in this Act shall be construed to authorize the Foundation to enter into any contractual or other arrangement inconsistent with any provision of law affecting the issuance or use of patents.

(b) No officer or employee of the Foundation shall acquire, retain, or transfer any rights, under the patent laws of the United States or otherwise, in any invention which he may make or produce in connection with performing his assigned activities and which is directly related to the subject matter thereof: *Provided, however*, That this subsection shall not be construed to prevent any officer or employee of the Foundation from executing any application for patent on any such invention for the purpose of assigning the same to the Govern-

ment or its nominee in accordance with such rules and regulations as the Director may establish.]

SEC. 12. Each contract or other arrangement executed pursuant to this Act which relates to scientific research shall contain provisions governing the disposition of inventions produced thereunder in a manner calculated to protect the public interest and the equities of the individual or organization with which the contract or other arrangement is executed: Provided, however, That nothing in this Act shall be construed to authorize the Foundation to enter into any contractual or other arrangement inconsistent with any provision of law affecting the issuance or use of patents.

VI. SECTIONAL ANALYSIS OF THE BILL H.R. 5842

A bill to authorize appropriations for activities of the National Science Foundation for fiscal years 1982 and 1983, and for other purposes.

TITLE I—AUTHORIZATION OF FUNDS FOR FISCAL YEAR 1982

Section 101

Authorizes appropriations to the National Science Foundation for fiscal year 1982, in the following categories:

	Thousands
1. Mathematical and physical sciences	$285,400
2. Engineering	100,400
3. Biological, behavioral, and social sciences	184,600
4. Astronomical, atmospheric, Earth, and ocean sciences	253,200
5. Ocean drilling programs	14,000
6. U.S. Antarctic program	69,600
7. Scientific, technological, and international affairs	46,400
8. Cross-directorate programs	13,200
9. Program development and management	63,200
10. Sciences and engineering education	35,000

Section 102

Provides an additional sum of $16.5 million for modernization of research equipment and facilities. (This is in addition to amounts authorized in sections 101 and 103.)

Section 103

Authorizes up to $3.5 million for expenses incurred by the Foundation outside the United States, to be drawn from excess foreign currencies.

Section 104

Authorizes up to $5,000 for official consultation, representation, or other extraordinary expenses at the discretion of the Director of the Foundation.

TITLE II—AUTHORIZATION OF FUNDS FOR FISCAL YEAR 1983

Section 201

Authorizes appropriations to the National Science Foundation for fiscal year 1983, in the following categories:

	Thousands
1. Mathematical and Physical Sciences	$288,300
2. Engineering	98,600
3. Biological, Behavioral and Social Sciences	201,000
4. Astronomical, Atmospheric, Earth and Ocean Sciences	250,800
5. Ocean Drilling Program	14,000
6. U.S. Antarctic Program	86,400
7. Scientific, Technological, and International Affairs	50,100
8. Program Development and Management	63,081
9. Science and Engineering Education	45,000

Section 202(a)

Requires at least $2,000,000 to be available for research to aid the handicapped, to be taken from the funds authorized for engineering.

Section 202(b)

Requires at least $3,000,000 to be available for the National Research Opportunity Grant Program, to be taken from the funds authorized for scientific, technological, and international affairs.

Section 202(c)

Requires that at least 10 per centum of the funds authorized to the mathematical and physical sciences, engineering, and astronomical, atmospheric, earth and ocean sciences programs, should be expended on research instrumentation.

Section 202(d)

Allows withdrawal of funds from the International Institute for applied Systems Analysis, on notification by the President that participation is contrary to national security interests.

Section 202(e)

Allows transfer of up to $9 million to the ocean drilling program for ocean margin drilling, from funds authorized for mathematical and physical sciences, engineering, and astronomical, atmospheric, earth and science programs. Notification of such transfer must be transmitted in writing to Congress, and can be acted on only if no objection is heard within 30 days.

Section 203

Authorizes up to $2.2 million for expenses incurred by the Foundation outside the United States, to be drawn from excess foreign currencies.

Section 204

Authorizes up to $2,500 for official consultation, representation, or other extraordinary expenses at the discretion of the Director of the Foundation.

TITLE III—AVAILABILITY OF FUNDS AND OTHER FUNCTIONS

Section 301

States that appropriations made under authorizations in Titles I and II can be utilized during the periods described in the appropriations bill.

Section 302

States that if the appropriation is less than the total authorized, every program activity, and every floor in the authorization bill, should be reduced by a proportional amount. The only exceptions would be those specified in the appropriations Act.

Section 303(a)

Permits transfer of funds between the categories in Section 101 and 201, as long as these do not exceed 10 per centum of the amounts authorized for those categories.

Section 303(b)

Permits the Director of the Foundation to transfer funds exceeding 10 per centum of the amount authorized for that category, following a written explanation to Congress, and if no objection is made within 30 days.

Section 304(a)

Amends the National Science Foundation Act of 1950 in two places. Changes the text of the original act with respect to special commissions to provide for greater flexibility in using such commissions.

Section 304(b)

Removes unnecessary codification for Resource Centers for Science and Engineering.

Section 304(c)

Deletes disclosure regulation.

Section 304(d)

Deletes provisions banning NSF employees from owning patents resulting from NSF-related work.

TITLE IV—DIRECTORATE FOR SCIENCE AND ENGINEERING EDUCATION

Section 401

Establishes the Directorate as a permanent entity, responsible for all science and engineering education activities within the Foundation.

Section 402

Requires the Director of the Foundation to inform Congress of any changes in the functions or organization of the Directorate, and prohibits any action unless no objection is heard within thirty days.

VII. Oversight Activities

HEARINGS

Testimony was given by NSF personnel or by others on NSF-related matters at oversight hearings held by the Committee between April 1981 and March 1982:

Information Science and Technology Act (H.R. 3137)—May 27, 28, June 9, 1981;

Commercializing University Biomedical Research—June 8, 9, 1981;

Seminar on Science and Technology Issues—Present and Future—June 24, 1981;

Implementation of the Stevenson-Wydler Technology Innovation Act (Public Law 96-480)—June 14, 15, 16, 1981;

Seminar on Innovation and Productivity: A Human Perspective—July 28, 1982;

The Human Factor in Innovation and Productivity—September 9, 10, 11, 15, 16, 17, 1981;

Hearing on Federal Patent Policy Bills (H.R. 4564 and S. 1657)—September 30, 1981;

Field Hearing—Formation and Development of High Technology (Columbus, Ohio)—October 5, 1981;

Engineering Manpower Concerns—October 6, 7, 1981;

The Uniform Federal Research and Development Utilization Act of 1981 Markup (H.R. 4564)—October 29, November 17, 1981;

Field Hearing—Forecasting Needs of High Technology and the Future (Boston, MA)—November 24, 1982;

The U.S. Science and Technology Budget Under Stress—December 10, 1981;

Field Hearing—Impact of Federal Budget Reductions on Engineering and Scientific Research Education (Middletown, Pa)—December 14, 1981;

Continuation of hearing from December, 1981, on Science and Technology Under Budget Stress, Full Committee—February 3, 1982;

Field Hearings, Pittsburgh, Science and Engineering Education—February 11, 1982;

Field Hearing, Columbus, Ohio, on Local Incentives for High-Technology Firms and Innovation—February 16, 1982;

Full Committee Hearing on Nobel Laureates—February 25, 1982.

INSPECTION OF NSF-SUPPORTED FACILITIES

University of Utah, NSF-supported Utah Innovation Center Native Plants, Inc., Salt Lake City, Utah—NSF-funded research re development of indigenous plants of new sources of rubber and hydrocarbon materials.

University of Colorado, Boulder Campus, and National Center for Atmospheric Research, Boulder, Colorado.

NSF-supported Southwest Resource Center at University of New Mexico, Albuquerque, NM.

High Resolution Electron Microscopy Facility at Arizona State University, Phoenix, AZ.

Glomar Explorer drill ship, at San Francisco, CA.

ATTENDANCE AT NSF MEETINGS

Committee staff members have attended, or have studied reports of, numerous NSF meetings of the following types: National Science Board meetings, program reviews, program planning sessions, scientific conferences, and advisory committee meetings.

They have also met with NSF personnel on a variety of working topics including: accountability in research and grant management; history, nature, and accomplishment of selected programs; evaluation procedures for grant proposals, amendments to NSF Organic Act, and Directorate-by-Directorate pre-budget reviews of programs, problems, and plans.

GAO REPORTS

The following General Accounting Office Reports issued in the past year deals with NSF:

1. "Impact of Budget Cuts on Three Directorates of the National Science Foundation"—January 26, 1982.
2. "Better Accountability Procedures Needed in NSF and NIH Research Grant Systems", September 30, 1981; PAD-81-29.

VIII. Oversight Findings and Recommendations by the Committee on Governmental Operations

Pursuant to clause 2(b)(2), rule X and clause 2(1)(3)(D), rule XI, of the Rules of the House of Representatives, the following oversight findings and recommendations made by the Committee on Government Operations have been received. No statement of findings and recommendations were received as of April 21, 1982.

IX Congressional Budget Act Cost Estimate

U.S. Congress,
Congressional Budget Office,
Washington, D.C., April 21, 1982.

Hon. Don Fuqua,
Chairman, Committee on Science and Technology, House of Representatives, Washington, D.C.

Dear Mr. Chairman: Pursuant to Section 403 of the Congressional Budget Act of 1974, the Congressional Budget Office has prepared the attached cost estimate for H.R. 5242, the National Science Foundation Authorization Act for Fiscal Years 1982 and 1983.

Should the Committee so desire, we would be pleased to provide further details on this estimate.

Sincerely,

Raymond C. Scheppach,
(Alice M. Rivlin, *Director*).

CONGRESSIONAL BUDGET OFFICE—COST ESTIMATE

1. Bill number: H.R. 5842.
2. Bill title: National Science Foundation Authorization Act for Fiscal Years 1982 and 1983.
3. Bill status: As ordered reported by the House Committee on Science and Technology, April 1, 1982.
4. Bill purpose: The bill provides authorizations for appropriations for both fiscal years 1982 and 1983. In title I of the bill, a total of $1,085 million is authorized for fiscal year 1982. This includes $1,030 million for research and related activities, $35 million for science and engineering education, $3.5 million for the special foreign currency

program, and $16.5 million for a special program for modernizing research equipment and facilities. The total of $1,085 million is $91 million over that appropriated to the National Science Foundation (NSF) for fiscal year 1982 in P.L. 97–101.

Title II of the bill authorizes a total of $1,099 million for the National Science Foundation for fiscal year 1983. This amount represents $30 million more than the President's request,[1] primarily because H.R. 5842 authorizes $45 million for the science and engineering education program, compared to the $15 million requested by the President. This title also earmarks specific amounts for research to aid the handicapped, for the national research opportunity grant program, and for research instrumentation. Finally, this title allows withdrawal of funds from the International Institute for Applied Systems Analysis upon notification by the President that participation is contrary to national security interests.

Title III outlines the conditions by which funds may be transferred among categories, deletes disclosure regulations now superseded by the Ethics in Government Act, deletes certain provisions of the National Science Foundation Act of 1950 banning NSF employees from owning patents resulting from NSF-related work, and amends the National Science Foundation Act of 1950 in regard to special commissions and the Resource Centers for Science and Engineering.

Title IV establishes the Directorate for Science and Engineering Education as a permanent organizational entity within the foundation.

5. Cost estimate:

[By fiscal years, in millions of dollars]

	1982	1983	1984	1985	1986	1987
Authorization level	1,085	1,099				
Less: Amounts already appropriated	994					
Net additional authorization	91	1,099				
Estimated outlays	41	573	398	114	64	

Including outlays from prior years' budget authority appropriated to date, total outlays would be $1,125 million in 1982 and $1,022 million in 1983, assuming appropriation of the authorized amounts.

The costs of this bill fall within budget function 250.

6. Basis of estimate: For the purposes of this estimate, it is assumed that the additional amounts authorized for fiscal year 1982 and the full amount authorized for fiscal year 1983 are appropriated. It is also assumed that the distribution of funds among NSF programs as stated in the bill is maintained. The estimate of anual outlays is based on historical spending patterns for NSF programs.

7. Estimate comparison: None.

8. Previous CBO estimate: None.

9. Estimate prepared by: Steve Martin (226–2860)

10. Estimate approved by:

JAMES L. BLUM,
Assistant Director for Budget Analysis.

[1] Excluding the President's request for the minority institutions science improvement program, which was proposed to be transferred from the Department of Education.

X. Impact on Inflation

In accordance with Clause 2(1)(4), Rule XI of the Rules of the House of Representatives, the following statement is made concerning the inflationary impact of H.R. 5842.

H.R. 5842 is assessed to have no inflationary effect on prices and costs in the operation of the national economy.

XI. Committee Recommendation

A quorum being present, the bill was ordered reported on April 1, 1982 by the Committee by voice vote.

XII. Administrative Views

National Science Foundation,
Washington, D.C.

Hon. Thomas P. O'Neil,
Speaker of the House,
House of Representatives,
Washington, D.C.

Dear Mr. Speaker: Public Law 90–407 requires that appropriations for the National Science Foundation to carry out its powers and duties have prior authorization from the Congress. Accordingly, I am enclosing a draft authorization bill for fiscal years 1983 and 1984 for the National Science Foundation, together with a sectional analysis.

This draft authorization bill is almost identical to that submitted for fiscal years 1982 and 1983. The only changes are in the amounts recommended for authorization and in Section 7, which proposes certain changes in the Foundation's organic act, the National Science Foundation Act of 1950. (We are enclosing an explanation of the proposed changes.)

The Office of Management and Budget has advised us that enactment of the proposed bill would be in accord with the program of the President.

Sincerely yours,

John B. Slaughter, *Director.*

Enclosures.

Authorization Bill—Fiscal Years 1983 and 1984

Be it enacted by the Senate and the House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Science Foundation Authorization Act for Fiscal Years 1983 and 1984."

Sec. 2(a). There is authorized to be appropriated to the National Science Foundation $1,067,281,000 for the fiscal year 1983 and such sums as may be necessary for fiscal year 1984.

(b) Funds authorized for fiscal year 1983 will be available for the following categories:

(1) Mathematical and Physical Sciences, $298,700,000.
(2) Engineering, $99,700,000.
(3) Biological, Behavioral, and Social Sciences, $186,700,000.

(4) Astronomical, Atmospheric, Earth and Ocean Sciences, $259,700,000.

(5) Ocean Drilling Programs, $14,000,000.

(6) Antarctic Research Programs, $86,400,000.

(7) Scientific, Technological, and International Affairs, $44,000,000.

(8) Program Development and Management, $63,081,000.

(9) Science and Engineering Education, $15,000,000.

SEC. 3. Appropriations made under authority provided in sections 2 and 5 shall remain available for obligation for periods specified in the Acts making the appropriations.

SEC. 4. From appropriations made under authorizations provided in this Act, not more than $2,500 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984 may be used for official consultation, representation, or other extraordinary expenses at the discretion of the Director of the National Science Foundation. His determination will be final and conclusive upon the accounting officers of the Government.

SEC. 5. Besides the sums authorized by section 2, not more than $2,200,000 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984 are authorized to be appropriated for expenses of the National Science Foundation incurred outside the United States, to be drawn from foreign currencies that the Treasury Department determines to be excess to the normal requirements of the United States.

SEC. 6. Funds may be transferred among the categories listed in section 2(b), so long as the net funds transferred to or from any category do not exceed 10 percent of the amount authorized for that category in section 2. The Director of the Foundation may propose transfers to or from any category exceeding 10 percent of the amounts authorized for that category in section 2. An explanation of any such proposed transfer must be transmitted in writing to the Speaker of the House, the President of the Senate, the Senate Committee on Labor and Human Resources, and the House Committee on Science and Technology. The proposed transfer may be made only when—

(1) thirty calendar days have passed after submission of the written proposal, or

(2) the chairman of the House Committee on Science and Technology and the chairman of the Senate Committee on Labor and Human Resources have each written the Director to the effect that the respective committee has no objection to the proposed transfer.

SEC. 7(a). Subsection 4(j) of the National Science Foundation Act of 1950, as amended, is amended to read as follows:

"(j)(1) The Board shall periodically render to the President, for submission to the Congress, a report on indicators of the state of science and engineering in the United States.

"(2) The Board shall render to the President, for submission to the Congress, reports on policy matters related to research and education in science and engineering, as the Board, the President, or Congress determines the need for such reports."

(b) Section 9 of the National Science Foundation Act of 1950, as amended, is amended to read as follows:

"(a) Each special commission established under section 4(h) shall be appointed by the Board and shall consist of such members as the Board considers appropriate.

"(b) Special Commissions may be established to study and make recommendations to the Foundation on issues relating to research and education in science and engineering."

(c) Section 6 of Public Law 95–99, the National Science Foundation Authorization Act for FY 1978, is deleted and the sections following it all renumbered accordingly.

(d) Section 10 of Public Law 95–99, the National Science Foundation Authorization Act for FY 1978, is deleted.

(e) Subsection 12(b) of the National Science Foundation Act of 1950, as amended, is deleted and the preceding subsection is redesignated by striking the "(a)".

SECTIONAL ANALYSIS—NSF FY 1983–1984 AUTHORIZATION BILL

A bill to authorize appropriations for activities of the National Science Foundation, and for other purposes.

Sec. 1. Permits the citation of the Act as the "National Science Foundation Authorization Act for Fiscal Years 1983 and 1984."

Sec. 2. Authorizes appropriations in nine activities totaling $1,067,281,000 for FY 1983 and such sums as may be necessary for FY 1984.

Sec. 3. Provides that appropriations made under sections 2 and 5 remain available for periods specified in appropriations acts.

Sec. 4. Authorizes expenditures of up to $2,500 for FY 1983 and such sums as may be necessary for FY 1984 for official consultation, representation, and other extraordinary expenses at the discretion of the Director.

Sec. 5. Authorizes, besides the appropriations in section 2, an appropriation not to exceed $2,200,000 for FY 1983 and such sums as may be necessary for FY 1984, for expenses of the National Science Foundation incurred outside the United States to be drawn from excess foreign currencies.

Sec. 6. Provides that funds may be transferred among categories but precludes transfers to or from any category exceeding 10 percent of the amount listed for that category until either:

(A) thirty calendar days have passed after the Director has notified the Speaker, the Vice President, and the Senate and House authorization committees of the nature of the transfer and the reason for it, or

(B) both authorization committees have written the Director that they have no objection to the transfer.

Sec. 7. Makes several amendments to the NSF Act.

SECTION 7 OF NSF FY 1983–1984 AUTHORIZATION BILL: PROPOSED CHANGES TO NATIONAL SCIENCE FOUNDATION ACT OF 1950

The submitted bill would make five amendments to the National Science Foundation Act and related laws. The first two proposed changes are matters of some current urgency, for reasons given in the individual explanations. All the proposed changes would serve a broad long-term purpose. They represent a continued collaboration between

the Foundation and the congressional committees charged with oversight of its activities to simplify and streamline its organic legislation. This effort serves two major purposes:

1. It provides NSF officials, members of the public, and Members of the Congress a clear, uncluttered, and current congressional statement of the Foundation's mission, functions, and operations. This allows clearer understanding and sharper focus on significant policy issues.

2. It contributes to current deregulatory efforts of the Congress. Although most deregulatory efforts focus on alleviating burdens on the private sector, even where removal of restrictions directly affects only a Federal agency such as the Foundation there is a positive effect. Government agencies suffer from inflexibility and misdirected effort brought on by outdated or unnecessary regulation just as individuals and business firms do. Deregulation requires that codified laws and regulations be made to contract where possible, instead of only expanding.

Proposed change No. 1

Subsection 4(j) of the National Science Foundation Act of 1950, as amended, is amended to read as follows:

(j) (1) The Board shall periodically render to the President, for submission to the Congress, a report on indicators of the state of science and engineering in the United States.

(2) The Board shall render to the President, for submissions to the Congress, reports on policy matters related to research and education in science and engineering, as the Board, the President, or Congress determines the need for such reports.

Explanation of proposed change No. 1

Subsection 4(j) of the NSF Act requires that the National Science Board (NSB) prepare annual reports to the President for submission to the Congress by March 31 of each year. This requirement has been fulfilled by submission in alternative years of Science Indicators and "topical" NSB reports. Subsection 7(a) amends subjection 4(j) to require that the NSB periodically render to the President a report on "indicators of the state of science and engineering in the United States." This would make Science Indicators, a well-used and popular report since its initial publication in 1973, legislatively mandated. It would not, however, write the current two-year cycle into law. Although the law would thus leave that decision to the NSB, the Foundation intends to continue the two-year cycle, and in any event would expect to alter the issuance schedule only after consultation with others in the Executive Branch and with the appropriate congressional committees.

Subsection 4(j) is further changed to require that reports on policy matters related to research and education in science and engineering be prepared by the NSB when it, the President, or the Congress determines the need for such reports.

The requirement that such "topical" reports be issued on a fixed cycle has proved artificial. The Foundation believes that the cost of reports would be reduced and their effectiveness increased if they were

made when there are matters on which the NSB, the President, or the Congress believes the NSB should report. That might be more often or less often than annually.

Proposed change No. 2

Section 9 of the National Science Foundation Act of 1950, as amended, is amended to read as follows:

(a) Each special commission established under section 4(h) shall be appointed by the Board and shall consist of such members as the Board considers appropriates.

(b) Special Commissions may be established to study and make recommendations to the Foundation on issues relating to research and education in science and engineering.

Explanation of proposed change No. 2

Section 4(h) of the National Science Foundation Act authorizes the National Science Board to establish "special commissions" from time to time as it may deem necessary for the purposes of the NSF Act. Such a commission can be a useful means of focussing the attention of distinguished scientists and other citizens on specific problems relating to science. However, limitations on the composition and duties of special commissions imposed in section 9 of the Act have unfortunately limited their value and therefore their use.

Section 9(b) of the NSF Act restricts any special commission to making a "comprehensive survey of research" and formulating and recommending to NSF an "over-all research program" for a particular scientific field of study. The Foundation believes that special commissions would be more helpful and used more often if the commissions' writs could be drawn more broadly. The proposed amendment would authorize the Board to establish special commissions to study and make recommendations on any issues relating to the principal areas of responsibility of the National Science Foundation.

Section 9(a) restricts the membership of any special commission to six scientists and five non-scientists. Though this may be a good number and a good distribution for many cases, it is extraordinarily rigid. In many other cases it would prevent selection of the best mix of scientists who are experts or specialists in the issues to be addressed, scientists who are not specialists in those issue, and nonscientists. The proposed amendment would allow the Board discretion to take account of the subject and the circumstances in fixing the size of a special commission and determining its composition.

No significant increase in cost or personnel will result if the proposal is enacted. Moreover, most, if not all, special commissions established would be considered to be subject to the requirements of the Federal Advisory Committee Act.

Proposed change No. 3

Section 6 of Public Law 95–99, the National Science Foundation Authorization Act for fiscal year 1978, is deleted and the sections following it all renumbered accordingly.

Explanation of proposed change No. 3

Section 6 of Public Law 95–99 directed the Foundation to establish a Resources Center for Science and Engineering to be located at an educational institution. Four such centers have been funded.

This section of the Foundation's annual authorization act was permanently codified in the U.S. Code as 42 U.S.C. § 1884, apparently as a matter of codification committee routine. The Foundation sees no reason for this codification. No other specific programs of the Foundation initiated at the direction of the Congress have been permanently codified. Moreover, authority for establishing such centers is now covered under the Science and Technology Equal Opportunities Act (42 U.S.C. §§ 1885–1885d), making this section redundant. Deletion of the section will simplify the law.

No increase in cost or personnel will result if the proposal is enacted.

Proposed change No. 4

Section 10 of Public Law 95–99, the National Science Foundation Authorization Act for fiscal year 1978, is deleted.

Explanation of proposed change

This lengthy provision, codified as 42 U.S.C. § 1873a, was added in 1977 to require NSF employees to disclose any financial interests or academic affiliations that might bear on their handling of proposals or other applications. It also required that the NSF adopt implementing regulations. It is unique, as no other agency of the Federal Government is subject to specific statutory requirements in this area. The broader disclosure requirements of the Ethics in Government Act are binding on all agencies, including the NSF. (In fact, under subsection (d), § 1873a(d), most of this section was superseded by the Ethics in Government Act.) Moreover, all agencies are required by Executive Order 11222 to maintain conflict-of-interests regulations that deal with any problems unique to their programs and methods of operation.

Existing NSF regulations do require disclosure of financial interests and academic affiliations by those who handle proposals. Proposed NSF regulations, recently published for public comment (47 Fed. Reg. 193–215, January 5, 1982), would go further and require both disclosure of all potentially biasing affiliations of relationships and special oversight in cases involving them, with further special handling if necessary. Proposed Regulations, Part 681, 47 Fed. Reg. at 199–200. The statutory provision is thus no longer necessary, and its deletion would simplify the law and allow more scope for future evolution of NSF policy in this area.

No increase in cost or personnel will result if the proposal is enacted.

Proposed change No. 5

Subsection 12(b) of the National Science Foundation Act of 1950, as amended, is deleted and the preceding subsection is redesignated by striking the "(a)".

Explanation of proposed change

Subsection 12(b) of the NSF Act, codified as 42 U.S.C. § 1871(b), bans an NSF employee from owning a United States patent on any invention made in connection with and directly relating to the subject matter of his or her assigned duties.

The Foundation is believed to be the only Federal agency to have a statutory provision governing the allocation of rights to inventions made by its employees. All other agencies are governed by Executive

Order 10096, as amended, which permits Federal employee-inventors to retain principal patent rights to their invention under certain circumstances. (See Section 1(c) of E.O. 10096 and the implementing regulations of the Patent and Trademark Office published at 37 CFR Part 100.)

No reason is known for this special restriction on the Foundation's employees. The provision probably resulted from a general congressional concern over the treatment of Federal employees' inventions, which President Harry Truman assuaged by issuing E.O. 10096 in January, 1950, just four months before the NSF Act became law.

As far as can be determined, the provision has had no actual effect on the Foundation's employees, since no employee-invention has ever been reported. The NSF, after all, performs no "in-house" research.

Deletion of this provision would simplify the law and remove an inequitable distinction between the Foundation's employees and those of other Federal agencies.

No increase in cost or personnel will result if the proposal is enacted.

XIII. BUDGET AS REQUESTED

National Science Foundation

WASHINGTON, D. C. 20550

BUDGET IN BRIEF

Fiscal Year 1983

TO
THE CONGRESS

(40)

National Science Foundation

Washington, D.C. 20550

FY 1983

Budget in Brief

to the Congress

NEW OBLIGATIONAL AUTHORITY

FY 1983 Budget Request	$1,072,768,000
FY 1982 Appropriation (P.L. 97-10)	1,035,080,000
Less Reductions Pursuant to P.L.- 7-101	-41,405,000
FY 1982 New Obligational Aut ority	993,675,000
Increase in New Obligational A thority FY 1983/FY 1982	79,093,000

Program Level

FY 1983	$1,072,768,000
FY 1982:	
Appropriation	1,035,080,000
Less Reductions	-41,405,000
Plus Carryover	2,564,264
FY 1982 Program Level	996,239,264
Increase in Program Level FY 198 /1982	$76,528,736

ABOUT THE NATIONAL SCIENCE FOUNDATION

What Is NSF?

The National Science Foundation (NSF) is an independent Federal agency established by the National Science Foundation Act of 1950 (P.L. 81-507) to promote and advance scientific progress in the United States. The concept of a National Science Foundation was an outgrowth of the important contributions made by science and technology during the Second World War. Since its establishment in 1950, NSF has occupied a unique place among Federal government agencies, with responsibility for the overall health of science across all disciplines, in contrast to other agencies that support research directed to specific missions.

What Does It Do?

NSF maintains U.S. scientific strength by funding research in all fields of science and engineering through grants and contracts to more than 2,000 colleges and universities and other research institutions in all parts of the U.S. The Foundation accounts for about 28 percent of Federal support for basic research going to academic institutions.

How Does It Do It?

NSF receives over 27,000 unsolicited proposals each year for research and graduate fellowships and makes over 12,000 awards. The awards go to universities, colleges, university consortia, not-for-profit institutions and small businesses. The Foundation supports cooperative research efforts by universities and industry. It operates no in-house laboratories; except for administrative costs (about 6 percent of the total), all funds appropriated to the Foundation go directly to non-Federal researchers.

How Is It Managed?

A 25-member National Science Board establishes policies for the Foundation, within the framework of applicable policies made by the President and the Congress. The Board, the Director of the Foundation, the Deputy Director, and four Assistant Directors are appointed by the President with the advice and consent of the Senate; three additional Assistant Directors are appointed by the Director. Approximately 1,200 other full-time NSF employees help administer the Foundation and its programs.

Foundation staff is assisted by advisors, primarily from the scientific community, who serve on formal advisory committees or as ad hoc reviewers of research proposals. This advisory system, which provides

advice both on program direction as well as on specific proposals, involves more than 30,000 scientists and engineers each year. NSF staff members--who are experts in science or engineering--make final award decisions. Applicants receive verbatim unsigned copies of peer reviews and can appeal award decisions through a formal mechanism.

How Well Does It Do It?

Research funded by NSF provides new knowledge and understanding in all fields of science and engineering and results in several thousand published articles, reports, and books each year. These publications provide the primary basis for those with expertise in the relevant disciplines and specialties to assess the quality and scientific significance of the work.

The Foundation has also established a program of systematic review of each of its scientific and engineering programs every three years by an oversight panel of external reviewers. The panels report to the NSF Director with answers to the following questions:

- o Is the program well managed?
- o Is the peer review process functioning properly?
- o Are the award decisions of Program Officers clear, documented, and appropriate?
- o Are there any significant imbalances in the program?
- o Within the limits of its budget is the program meeting its objectives?

Why Does It Do It?

By establishing NSF, the Federal Government recognized that support of long-term fundamental research in all fields of science and engineering, and the teaching and learning of science contribute to the strength and well-being of the Nation in many ways. Research discoveries precede and underlie advances in many important areas of Federal responsibility including national defense, industrial productivity, health, energy, environment and agriculture. Scientists and engineers help create the future through developing new understandings, ideas, techniques and applications--and new generations of scientists are educated through their work as graduate students on research projects.

NATIONAL SCIENCE FOUNDATION

FY 1983 BUDGET IN BRIEF

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NATIONAL SCIENCE FOUNDATION
TOTAL DOLLAR SUMMARY
FY 1981—FY 1983

(Millions of Dollars)

Source	Actual FY 1981	Amended Request FY 1982	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/82
Obligational Authority	$1,096.1	$1,033.5	$1,035.1	$1,072.8	$37.7
Carryover	2.2	—0—	2.8	—0—	-2.6
Recission	-56.0	—0—	—0—	—0—	—0—
Reductions	-2.5	—0—	-41.4	—0—	41.4
Total	1,041.8	1,033.5	996.3	1,072.8	76.5

NATIONAL SCIENCE FOUNDATION

SUMMARY OF FY 1983 BUDGET BY APPROPRIATION AND PROGRAM

	Actual FY 1981	Amended Request FY 1982	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/82
RESEARCH & RELATED ACTIVITIES APPROPRIATION					
Mathematical and Physical Sciences	$251,331,247	$289,910,000	$267,400,000	$291,900,000	$24,500,000
Transferred Responsibilities	5,153,000	5,500,000	5,500,000	6,800,000	1,300,000
Total, MPS	256,484,247	295,410,000	272,900,000	298,700,000	25,800,000
Engineering	84,996,655	101,360,000	90,800,000	99,700,000	8,900,000
Project Transfer	1,350,000	1,200,000	1,200,000	—0—	-1,200,000
Total Engineering	86,346,655	102,560,000	92,000,000	99,700,000	7,700,000
Biological, Behavioral and Social Sciences	185,582,539	171,980,000	176,000,000	186,700,000	10,700,000
Astronomical, Atmospheric, Earth and Ocean Sciences	236,291,406	253,150,000	240,000,000	259,700,000	19,700,000
Ocean Drilling Programs	21,999,999	26,000,000	20,000,000	14,000,000	-6,000,000
Antarctic Research Programs	67,454,493	70,100,000	66,000,000	73,000,000	7,000,000
Transfer of Responsibility	—0—	—0—	—0—	13,400,000	13,400,000
Total, USAP	67,454,493	70,100,000	66,000,000	86,400,000	20,400,000
Scientific, Technological, and International Affairs	53,752,255	37,700,000	40,293,893	44,000,000	3,706,107
Minority Institutions Science Improvement Program	4,981,000*	(N/A)*	(4,800,000)*	3,287,000	3,287,000
Program Development and Management	59,207,459	63,200,000	63,515,037	63,081,000	-434,037
Subtotal, Obligations	967,119,053	1,020,100,000	970,708,930	1,055,568,000	84,859,070
Funding Reconciliation					
Unobligated Balances Brought Forward	-1,572,323	—0—	-1,013,930	—0—	1,013,930
Deferrals	-16,000,000	—0—	—0—	—0—	—0—
Rescission	46,000,000	—0—	—0—	—0—	—0—
Reduction Pursuant to P.L. 97-101	---	—0—	40,305,000	—0—	-40,305,000
Unobligated Balance Carried Forward	1,013,930	—0—	—0—	—0—	—0—
Adjustments to Prior Year Accounts	-4,025,352	—0—	—0—	—0—	—0—
Unobligated Balance Lapsing	123,692	—0—	—0—	—0—	—0—
Research and Related Activities Appropriation	992,659,000	1,020,100,000	1,010,000,000	1,055,568,000	45,568,000
Science and Engineering Education Activities Appropriation					
Scientific Personnel Improvement	33,369,803	9,900,000	16,800,000	15,000,000	-1,800,000
Science Education Resources Improvement	17,832,983	—0—	—0—	—0—	—0—
Science Education Development and Research	10,870,107	—0—	2,200,000	—0—	-2,200,000
Science Education Communication	8,590,716	—0—	1,200,000	—0—	-1,200,000
NSB Commission on Pre-College Education	—0—	—0—	700,000	—0—	-700,000
Subtotal, Obligations	70,663,609	9,900,000	20,900,000	15,000,000	-5,900,000
Funding Reconciliation					
Rescission	10,000,000	—0—	—0—	—0—	—0—
Reduction Pursuant to P.L. 96-526	2,496,000	—0—	—0—	—0—	—0—
Reduction Pursuant to P.L. 97-101	—0—	—0—	1,100,000	—0—	-1,100,000
Unobligated Balance Lapsing	40,391	—0—	—0—	—0—	—0—
Science and Engineering Education Activities Appropriation	83,200,000	9,900,000	22,000,000	15,000,000	-7,000,000

NATIONAL SCIENCE FOUNDATION

SUMMARY OF FY 1983 BUDGET BY APPROPRIATION AND PROGRAM
(Continued)

	Actual FY 1981	*Amended Request FY 1982*	*Current Plan FY 1982*	*Estimate FY 1983*	*Difference FY 1983/82*
Special Foreign Currency Appropriation					
Research and Related Activities	2,945,015	2,500,000	4,630,334	2,200,000	-2,430,334
Science Information	1,050,000	1,000,000	—0—	—0—	—0—
Subtotal, Obligations	3,995,015	3,500,000	4,630,334	2,200,000	-2,430,334
Funding Reconciliation					
Unobligated Balance Brought Forward	-639,535	—0—	-1,550,334	—0—	1,550,334
Unobligated Balance Carried Forward	1,550,334	—0—	—0—	—0—	—0—
Adjustments to Prior Year Accounts	-44,384	—0—	—0—	—0—	—0—
Unobligated Balance Lapsing	138,570	—0—	—0—	—0—	—0—
Special Foreign Currency Appropriation	5,000,000	3,500,000	3,080,000	2,200,000	-880,000
TOTAL NSF APPROPRIATIONS	**1,080,859,000**	**1,033,500,000**	**1,035,080,000**	**1,072,768,000**	**37,688,000**

OVERVIEW AND HIGHLIGHTS

The realization of national goals in the decade of the 1980's--sustained, real economic growth; enhanced national security; and improved quality of life for all citizens--depends critically on the continued development of new knowledge, new technology, and trained scientists and engineers from the Nation's investment in fundamental research.

While no one can foresee the exact nature of the problems or needs which this country will face tomorrow, we can be certain that basic scientific and engineering knowledge will lay the groundwork for addressing them. Just as past national investment in research has produced a U.S. science and engineering capability that is preeminent in a broad range of fields, so today's investments will maintain and build on these strengths to provide a strong foundation for the Nation's future economic and social well-being.

The National Science Foundation's role in helping to realize these national goals is to provide the tools and support needed to continue building the base of knowledge and experience on which innovators and managers can draw in the future. It accomplishes this primarily through the continuing, selective support of high quality, fundamental research in a broad variety of scientific and engineering disciplines.

In a period of very constrained budgets for many Federal agencies and programs, the FY 1983 Foundation Budget Request nevertheless represents an overall increase of 7.7 percent above the FY 1982 Current Plan. At the current estimated rate of inflation for 1983 of 6.5 percent, this represents overall real growth of 1.2 percent. This reflects the high priority given NSF programs by the Administration in the achievement of these national goals. This Budget Request has been designed to maximize the Foundation's long-term contribution to their accomplishment.

In the course of developing this Budget Request, it became clear that there are a number of opportunities and challenges facing the NSF and other institutions involved in the support and conduct of research in the 1980's. These opportunities and challenges are vitally important to the full realization of our national goals. Five, in particular, stand out: improving the state of the scientific and engineering research instrumentation base; exploring and developing new links between academic institutions and private industry; reducing shortages of faculty in such fields as computer science and parts of engineering; expanding the personnel resources for science by attracting members of groups underrepresented in scientific and engineering research careers; and improving the quality of primary and secondary education in mathematics and the physical sciences.

These challenges are highlighted in the section which follows the description of programmatic trends in the FY 1983 Budget Request. While the NSF addresses some of them in its program plans for FY 1983, they are by their very nature much broader than the responsibility of a single agency or even the Federal government. It is important that they be addressed by other parts of the science and engineering enterprise as well. They are outlined here in order to encourage and broaden, the dialogue.

The Federal Role in Basic Research

It is estimated that in FY 1981 the Federal government provided about $5.7 billion or almost 70 percent of the total national investment in basic research. In the same year, the industrial sector accounted for approximately 16 percent of the total, a figure which has declined since the early 1960's when industrial funding constituted about 30 percent of total investment in basic research. The remaining basic research funds were provided by the academic sector (10 percent) and nonprofit institutions (4 percent).

Recent changes in tax policy coupled with the Administration's high priority for reducing regulations which might inhibit technological innovation and risk taking are intended, in part, to encourage expanded support of research and development by industry. However, industrial research investments are directed primarily into areas which appear to be most promising for short and intermediate-term payoffs. Other areas where risk and uncertainty are higher or where large, long-term commitments are required are unlikely to be given adequate attention.

Since the 1950's, the rationale for Federal investment in fundamental research in science and engineering has been well developed and has become generally accepted. Federal support of such research is justified either when the government itself is a direct user of the results, as in the case of national defense, or when important, broad areas of high risk science and engineering research are underfunded, in terms of their potential long-term payoff, by the private sector. It is this latter research which provides much of the knowledge base upon which solutions to our current and future economic, social and technological problems, many currently unforeseen, will ultimately depend. This is where the activities of the NSF make their contributions to the Nation.

The NSF Role in Research

In FY 1981 the National Science Foundation's basic research obligations of $898.5 million accounted for almost one-fifth of the total Federal support of basic research. Its programs are, in part, designed in light of the basic research programs of mission agencies. In addition, NSF programs are responsive to the "intellectual marketplace" of ideas and research proposals arising from the activities and interests of scientists and engineers in the Nation's universities, colleges, and other research institutions. The Foundation's proposal review system is a competitive, national evaluation of research ideas and is designed to select and fund only those projects of the highest scientific promise and merit. This system allows for the free flow of ideas and basic discoveries and enables the Foundation to adjust its plans and priorities to take advantage of promising emerging research opportunities.

The NSF provides support for the tools and research facilities that are necessary for significant scientific advancement in many disciplines. This support ranges from purchases of equipment in individual research projects to

the support of major user facilities in physics and materials research, the academic research fleet in oceanography research, five national astronomy centers and a national atmospheric research center. In addition, it conducts the U.S. Antarctic Program, the principal expression of active U.S. interest in that continent under the Antarctic Treaty.

NSF programs are particularly important for the academic sector. In FY 1981, NSF provided about 28 percent of the total Federal research support to academic institutions. In a few fields such as mathematics, computer science, and anthropology, NSF supported half to more than two-thirds of the basic research conducted in academic institutions in FY 1981. In other fields such as economics, electrical engineering and some of the earth sciences, the Foundation provided one-third to two-fifths of the available funding. These data illustrate the breadth and significance of NSF's responsibilities in university based research.

The distinction between "basic" and "applied" research is often less relevant than the potential contribution to knowledge arising from research. Prior to FY 1981, the Foundation had a separate, applied research activity which supported work in a number of important national problem areas. During FY 1981, a reorganization was carried out with each part of the Foundation being given responsibility for reviewing and supporting applied work of high quality and scientific promise within its disciplinary purview. A total of $58.9 million was obligated for this purpose in FY 1981 and a new tracking system was instituted to enable the Foundation to monitor its management of applied research responsibilities. In the same year, new emphasis was given to fundamental research in engineering. A separate directorate for engineering was established and NSF placed special emphasis on engineering research.

NSF FY 1983 Budget Request

The Foundation's FY 1983 Budget Request totals $1,072.8 million, an increase of $76.6 million or 7.7 percent above the FY 1982 Current Plan of $996.2 million. It includes $1,055.6 million for Research and Related Activities, $15.0 million for graduate research fellowships, and $2.2 million for Special Foreign Currency.

At the current estimated rate of inflation of 6.5 percent, the increase for Research and Related Activities over FY 1982 of $84.9 million is 8.7 percent. Exclusive of transfers of responsibility to NSF, this increase represents some real growth in research support. This growth in a period of general budgetary constraint underlines the importance which the Administration attaches to the support of fundamental research and to maintaining the vitality and health of the Nation's research enterprise and the role of the Foundation in that enterprise.

The budget request was developed within the context of the President's economic recovery program with its emphases on reducing taxes and holding down the level of future Federal budget outlays as primary mechanisms for controlling inflation and stimulating long-term economic growth. All elements

of the Nation, including the scientific and engineering research communities, will benefit if these critical economic objectives are realized.

As part of the NSF's contribution toward the achievement of these objectives, all program activities and priorities were carefully reviewed to insure that those included in the FY 1983 request to the Congress would provide the largest possible return on the dollars invested, in terms of a strong scientific and engineering knowledge base for the future. Numerous individuals and groups were involved in these assessments during the past nine months, including the members of the National Science Board; representatives from the academic and industrial research communities who serve on various NSF advisory committees; the Foundation's management and professional staff; and representatives of the Office of Science and Technology Policy (OSTP) and of the Office of Management and Budget (OMB).

Throughout these assessments, several criteria were applied in reaching the judgments reflected in the FY 1983 budget request. First, emphasis was placed on maintaining scientific excellence. Projects of lesser scientific promise or urgency will have to be postponed, extended, or in some instances phased out in order to focus available resources on undertakings of the highest merit and potential scientific significance. Secondly, a broad base of support across all disciplines was maintained, with emphasis on certain areas such as engineering, computer science, and the earth sciences. This is in recognition of the importance of these areas to the economy, the pace of work in these disciplines, and the critical role the Foundation plays in their support. Also, provision was made in the FY 1983 request to continue selective support for expanding the scientific and engineering personnel resource base by increasing support for research efforts by women and minorities.

Programmatic Objectives and Highlights of the FY 1983 Request

In FY 1983, the Foundation's budget request is organized around eleven budget activities.

Five of these activities are structured primarily around science and engineering disciplines, together with the facilities and operations required for research in these disciplines. These five are Mathematical and Physical Sciences; Engineering; Biological, Behavioral, and Social Sciences; Astronomical, Atmospheric, Earth, and Ocean Sciences; and Ocean Drilling Programs.

The U.S. Antarctic Program represents the sole U.S. presence in Antarctica under the Antarctic Treaty.

The Scientific, Technological and International Affairs activity embodies a variety of Foundation responsibilities which frequently cut across scientific and engineering disciplines, including industry/university cooperative projects, science policy research, and international scientific activities, among others.

The Minority Institutions Scientific Improvement Program activity is proposed for transfer to NSF from the Department of Education in FY 1983. It is designed to provide support to a specific group of academic institutions in order to upgrade their scientific and engineering educational capabilities.

The Science and Engineering Education activity consists exclusively of a graduate fellowship program which will provide stipends and cost-of-education allowances to highly capable graduate science students who are selected in a national competition.

The Program Development and Management activity provides the resources such as salaries, travel, equipment, rent, and communications necessary to conduct the Foundation's day-to-day business.

The Special Foreign Currency activity supports scientific research and related efforts in selected countries where foreign currencies owned by the United States are designated as excess to federal requirements.

The objectives and highlights of each budget activity follow.

MATHEMATICAL AND PHYSICAL SCIENCES (MPS)

The objective of the Mathematical and Physical Sciences (MPS) activity is to increase fundamental understanding of the physical laws that govern the world and the universe in which we live. To achieve this objective, MPS uses a wide range of research support modes, including individual or group research projects, special instrumentation grants, university research laboratories and national user facilities, while supporting research across a spectrum of disciplines and scientific specialties. Support is provided for research in mathematics, computer science, physics, chemistry, and materials research.

The FY 1983 Budget Request for this activity is $298.7 million, an increase of $25.8 million or 9.5 percent above the Current Plan for FY 1982 of $272.9 million. At the request level:

- Previous emphasis on experimental computer science research is carried forward, including planned support for approximately 12 computer research facilities at academic institutions.
- Support is provided for detector and storage ring improvements at the Cornell Electron Storage Ring.
- Installation of a "cooler" storage ring to improve the energy resolution of the ion beams is initiated at the Indiana University Cyclotron.
- Responsibility for construction of the Phase II Michigan State University heavy ion accelerator is transferred from the Department of Energy to NSF. Funds for this purpose are included in the FY 1983 Request for support of Nuclear Physics research.

- Responsibility for funding the Stanford Synchrotron Research Laboratory is transferred from NSF to the Department of Energy. As a result, the amount requested by the Foundation for support of synchrotron radiation facilities under the Materials Research program is decreased accordingly.

- Overall support for individual project research is increased by about 8 percent to maintain approximately a constant level of effort across all disciplines. Award size is selectively increased in some disciplines and subfields.

ENGINEERING (ENG)

The goals of the Engineering activity are to (i) advance fundamental knowledge of engineering principles that can be applied to the analysis and design of man-made devices, systems and processes; (ii) focus research attention in areas relevant to selected national problems; and (iii) strengthen the infrastructure of the engineering research community. While this activity provides some support for selected research facilities, it primarily funds individual research projects, including a special research initiation program for young investigators. It also works in close cooperation with the University/Industry Cooperative Research program supported under the Scientific, Technological and International Affairs (STIA) activity.

The Budget Request for this activity is $99.7 million. The Request represents an increase of $8.9 million or 9.8 percent more than the FY 1982 Current Plan of $90.8 million (exclusive of $1.2 million for strong ground motion array data transferred to the U.S. Geological Survey in FY 1983). Within this amount:

- Emphasis is placed on research in microelectronics and on work related to robotics, manufacturing, and the development of novel chemical and separation processes central to chemical process technology.

- Support of research in geotechnical engineering, structural mechanics, and water resources and environmental engineering is increased by over 10 percent, while earthquake research is maintained at about the FY 1982 level.

- Overall there will be a slight increase in the number of estimated awards to be made in FY 1983 with an estimated increase of about 6 percent in the average size of awards.

BIOLOGICAL, BEHAVIORAL, AND SOCIAL SCIENCES (BBS)

The objective of the Biological, Behavioral, and Social Sciences activity is to increase basic understanding of life forms and life processes. It accomplishes this objective through the support of individual research projects ranging from studies of the fundamental molecules of living organisms to studies of the complex interrelationships between human populations and their institutions.

The FY 1983 Budget Request for this activity is $186.7 million, an increase of $10.7 million or 6.1 percent above the FY 1982 Current Plan of $176.0 million. Within the amount requested:

- Emphasis is placed on the biological sciences, which receive an increase of 7.1 percent over FY 1982. Special attention is given to research on nitrogen fixation and photosynthesis; cellular and neurochemical mechanisms of nerve growth and development; and the long-term response of ecosystems to environmental perturbations.

- Support is provided for continuation of instrumentation upgrading at marine biological stations.

- Support for work in the social, behavioral and information sciences remains approximately level with FY 1982.

- The overall number of estimated individual awards will decline slightly from the FY 1982 level with a 9 percent increase in the average size of awards.

ASTRONOMICAL, ATMOSPHERIC, EARTH AND OCEAN SCIENCES (AAEO)

The objectives of the Astronomical, Atmospheric, Earth and Ocean Sciences activity are to (i) increase understanding of the physical nature of the universe; (ii) advance knowledge of the earth's atmosphere; (iii) provide further insights into the physical and chemical composition of the earth and its geologic history; (iv) improve knowledge of the world's oceans, and sea floor, and the living creatures they nurture; and (v) advance knowledge of natural phenomena in the Arctic. The activity provides support directly to individual investigators; it also supports major research facilities, including the National Center for Atmospheric Research and the National Astronomical Observatories.

The FY 1983 Budget Request for the AAEO activity is $259.7 million, an increase of $19.7 million or 8.2 percent above the FY 1982 Current Plan of $240.0 million.

This provides for:

- A special emphasis in the Earth Sciences, including a full-year seismic profiling program, expanded support for geochemical

instrumentation, and a research thrust to increase understanding of the structure and evolution of the continental crust.

- o Maintenance of the FY 1982 level of effort in the astronomical and atmospheric sciences, including support for continued development of research instrumentation.

- o Upgrading the ships and on-board scientific equipment of the academic fleet and continuing support for basic oceanographic research, with emphasis on biological and chemical phenomena in the world's oceans.

- o Maintaining the number of individual awards level with FY 1982 and increasing the average award size by 9 percent.

OCEAN DRILLING PROGRAMS (ODP)

The objective of the Ocean Drilling Program activity is to achieve an understanding of the detailed composition and behavior of the submerged portion of the earth's surface. It is an interdisciplinary science program which, since 1968, has supported a unique worldwide effort to explore the earth's crust beneath the oceans.

The Budget Request for this activity for FY 1983 is $14.0 million, a decrease of $6.0 million or 30.0 percent from the FY 1982 Current Plan of $20.0 million. This request provides for continued operation of the drilling ship Glomar Challenger through FY 1983, currently planned as the final year of the Deep Sea Drilling Project.

A decision will be made in the summer of 1982 on whether to recommend the modification of the ship Glomar Explorer as a replacement for Challenger. If this is recommended, reprogramming of about $9.0 million in FY 1983 from other Foundation research activities would be required. In preparation for making that decision, scientific planning activities, along with cost and engineering studies on Explorer conversion, are underway.

The Ocean Margin Drilling program was terminated in October, 1981, partly because of changes in the Federal budget outlook, and partly because of the Foundation's inability to obtain an oil industry-wide agreement to support the activity jointly with the Foundation.

U.S. ANTARCTIC PROGRAM (USAP)

The National Science Foundation has been responsible for managing and funding the U.S. Antarctic Program since 1972. Both the President and the Congress have recognized that this responsibility is in addition to the usual activities of NSF. U.S. policy calls for the maintenance of an active,

national presence in Antarctica. Support of scientific research has been the principal expression of this presence, which includes:

- o Two coastal and two inland stations manned year-round, including the South Pole station.
- o A substantial logistic system, including a dedicated, heavy airlift capability, support and staging bases; and U.S. Coast Guard icebreaker support.
- o A balanced, multi-disciplinary research program with significant international cooperation.

The FY 1983 Budget Request for the U.S. Antarctic Program activity is $86.4 million. This total includes $13.4 million which reflects a transfer of responsibility for icebreaker support to the NSF from the U.S. Coast Guard. This transfer represents a policy change to include the total, rather than incremental, operating costs of icebreakers in the budget requests of Federal agencies which employ such ships in program support.

Exclusive of this transfer, the increase for support of this activity is $7.0 million or 10.6 percent above the FY 1982 Current Plan of $66.0 million. This increase in FY 1983 will be used to:

- o Expand support for climate, marine, geological and oceanographic research.
- o Provide for the increased costs of operations support.
- o Replace certain obsolescent buildings and equipment, especially at McMurdo Station.

SCIENTIFIC, TECHNOLOGICAL, AND INTERNATIONAL AFFAIRS (STIA)

The Scientific, Technological, and International Affairs activity supports and performs research and analysis to link performers of research with users of research (industry, small business, and State and local governments); exchange scientific and technical information internationally and facilitate international cooperation; serve science and technology decision makers and the public with policy-oriented data, information and analysis; and strengthen the science base by expanding opportunities for all qualified segments of the performing community to contribute to high quality research. STIA achieves these goals by supporting: joint research between universities and industry; small business innovation research; cooperative scientific activities with both advanced and developing countries; studies on the state of the research enterprise and its impact on the economy and society; and programs which contribute to development of the Nation's science and engineering infrastructure.

In FY 1982, a new subactivity, Coordinated Agency-Wide Research Activities (CARA) was budgeted under the STIA activity. Most of the program elements included in CARA were formerly displayed under Cross-Directorate Programs, which was discontinued as a separate activity in FY 1982.

Exclusive of CARA, the FY 1983 Budget Request for the STIA Activity is $32.7 million, an increase of $1.2 million or 3.8 percent more than the FY 1982 Current Plan of $31.5 million. Within this requested amount:

- Support for U.S. scientists participating in bilateral, international scientific activities is increased.
- Funds are provided to continue work on the development of academic scientific instrumentation indicators.
- Support for research by small, high technology firms is increased by 10 percent over FY 1982.
- One additional Industry/University Cooperative Research Center will be established, and planning grants for several new centers will be awarded.
- Increased support for research on issues of public policy is focused on ethical and value aspects underlying developments in science and technology.
- The Foundation will continue supporting liaison and information exchange efforts to encourage more effective use of science and technology by State and local governments.

The FY 1983 Budget Request for the CARA subactivity is $11.3 million, an increase of $2.5 million or 28.4 percent above the FY 1982 plan of $8.8 million. This amount provides for:

- A doubling of the Visiting Professorships for Women program from $0.5 million to $1.0 million.
- An expansion of the Research Improvement in Minority Institutions program from $0.5 million to $2.0 million. This program was initiated in FY 1982 in response to the President's Executive Order 12230.
- An increase of the Minority Research Initiation program from $1.7 million to $2.5 million.

As in FY 1982, funds for support of the 2- and 4-year college instrumentation program; regional instrumentation facilities; and the Alan T. Waterman Award will not be separately designated. However, these programs will be supported from the relevant research activities.

MINORITY INSTITUTIONS SCIENCE IMPROVEMENT PROGRAM (MISIP)

The goal of the Minority Institution Science Improvement Program activity is to increase access for underrepresented ethnic minorities to scientific and technological careers. To meet its goal, the program provides support for strengthening science programs in 2-year and 4-year institutions where students are predominantly Alaskan Native, American Indian, Black, Mexican American, Puerto Rican or other disadvantaged ethnic minorities who are statistically underrepresented in science and engineering. Responsibility for this activity will be transferred to NSF when the Department of Education is reorganized.

The FY 1983 Budget Request for the MISIP activity is $3.3 million, a decrease of $1.5 million or 31.2 percent from the FY 1982 Current Plan of $4.8 million. Within this reduced budget, efforts will be focused on:

- o Consortium-cooperative projects which maximize improvement of participation of minorities in science and engineering.
- o Activities at minority institutions which open opportunities for precollege students to interact with practicing scientists and engineers.

PROGRAM DEVELOPMENT AND MANAGEMENT (PD&M)

The goal of the Program Development and Management activity is to provide resources for the effective management of NSF.

The FY 1983 Budget Request for the PD&M activity is $63.1 million, which represents a decrease of $0.4 million from the FY 1982 Current Plan of $63.5 million. The number of Full-Time Equivalent employees for the Foundation is reduced from 1,301 in FY 1982 to 1,238 in the FY 1983 Request, a decrease of 5.0 percent.

Within the amount requested for FY 1983:

- o Personnel compensation and benefits are funded at $44.6 million, a decrease of $0.6 million or 1.3 percent below the FY 1982 amount.
- o Travel for staff, proposal reviewers, panelists and advisers is decreased by $0.25 million or 8 percent below the FY 1982 amount.
- o An increase of $0.3 million is provided for purchase of additional data processing equipment.
- o Other items will be maintained at the FY 1982 levels.

SCIENCE AND ENGINEERING EDUCATION (SEE)

The FY 1983 Budget Request for the Science and Engineering Education activity is $15.0 million for NSF Graduate Fellowships and Minority Graduate Fellowships.

The FY 1982 Current Plan for the SEE activity totals $20.9 million, including $15.0 million for graduate research fellowships. The balance supported existing program commitments and the National Science Board Commission on Precollege Education in Mathematics, Science and Technology.

The request for FY 1983 will support approximately 1,390 new and continuing graduate research fellows at an annual stipend of $6,900 plus a cost-of-education allowance of $4,000 per year.

Some Opportunities and Challenges for the 1980's

The decade of the 1980's poses a number of challenges and opportunities for all institutions and individuals involved in the support, leadership, and performance of the Nation's scientific and engineering research activities. The challenges include: improving the state of the scientific and engineering research instrumentation base; exploring and developing new research links between academic institutions and private industry; reducing shortages of faculty in such fields as computer science and parts of engineering; expanding the personnel resource pool for science by attracting members of groups underrepresented in scientific and engineering research careers; and improving preparation for research careers in science and engineering.

Although some of these challenges are being directly addressed in the Foundation's FY 1983 Budget Request and program plans, they entail, by their very nature, a much broader responsibility than that of a single agency or even the Federal government as a whole. Thus, these challenges need to be addressed by other parts of the science and engineering research enterprise as well. Such attention is especially important when, during a period of constrained budgets and economic uncertainty, there is a tendency to look inward, to avoid change, or to focus on narrower concerns and values at the expense of long-term opportunities and objectives.

RESEARCH INSTRUMENTATION AND LABORATORIES

Much research today is instrument-dependent and many advances can only be made through improvement of instrumentation. Investment in research instrumentation is an investment in the future growth and productivity of modern science and engineering.

There is growing recognition that, as a Nation, we may be underinvesting in state-of-the art instrumentation and associated facilities in academic

institutions. Such investment is critical to the conduct of cutting-edge research and the overall advancement of the Nation's science and technology base. In the FY 1983 Budget Request, the Foundation is addressing this problem in multiple ways through the research programs for each discipline.

R&D EQUIPMENT AND INSTRUMENTATION
(Obligations in millions of dollars)

Program Activity	Major Equipment*			Other Equipment & Instrumentation**		
	Actual FY 1981	Estimate FY 1982	Estimate FY 1983	Actual FY 1981	Estimate FY 1982	Estimate FY 1983
Research and Related Activities:						
Mathematical and Physical Sciences	$3.7	$5.1	$7.2	$32.4	$33.9	$37.7
Engineering	.9	.6	1.3	5.3	6.2	7.1
Biological, Behavioral, and Social Sciences	.0	.0	.0	15.2	15.0	16.1
Astronomical, Atmospheric Earth and Ocean Sciences	2.1	2.1	1.7	17.5	17.2	19.1
Ocean Drilling Programs	.0	.0	.0	0	.0	.0
U.S. Antarctic Program	.0	.0	.0	2.0	2.1	2.2
Scientific, Technological and International Affairs	.0	.0	.0	6.5	1.4	1.8
Minority Institution Science Improvement Program	.0	.0	.0	1.6	1.6	1.1
Program Development and Management	.0	.0	.0	.0	.0	.0
Subtotal, Research and Related Activities	6.7	7.8	10.2	80.5	77.4	85.1
Science and Engineering Education	.0	.0	.0	6.2	.3	.0
Special Foreign Currency	.0	.0	.0	.0	.0	.0
Total, NSF	$6.7	$7.8	$10.2	$86.7	$77.7	$85.1

* *Major Equipment*—Applies to a relatively limited number of specific items of specialized R&D equipment, such as accelerators, telescopes, research ships, aircraft, and the like.

** *Other Equipment and Instrumentation*—Includes R&D equipment other than those items specifically categorized as "Major Equipment". To qualify as equipment, an item must cost at least $300 and have a use-life of at least one year. Items in this category are treated as part of the cost of "Conduct of R&D".

This strategy facilitates an assessment of instrumentation needs relative to other research requirements and permits maximum flexibility, within the requested levels, for responding to the varying priorities and needs of different disciplines.

The FY 1983 Budget Request contains estimated obligations of $109.2 million for research facilities, instrumentation, and equipment. Within that total, major equipment and other instrumentation alone will equal $95.3 million or 11.5 percent over the FY 1982 Current Plan of $85.5 million.

SUMMARY—R&D FACILITIES, EQUIPMENT AND INSTRUMENTATION
(Obligations in millions of dollars)

	Actual FY 1981	Estimate FY 1982	Estimate FY 1983
Land, Buildings, and Fixed Equipment*	$8.0	$3.2	$13.9
Major Equipment	6.7	7.8	10.2
Other Equipment and Instrumentation	86.7	77.7	85.1
Total, NSF	$101.4	$88.7	$109.2

* *Land, Buildings, and Fixed Equipment*—Acquisition, construction, rehabilitation, addition to, or improvement of real property assets, such as land, buildings, or other structures, and fixed equipment. "Fixed equipment" means equipment that is part of the building, such as elevators, plumbing, lighting and heating systems, air conditioning systems, fire alarm systems, and the like.

There are opportunities here for other Federal R&D funding agencies to respond to instrumentation needs. And, indeed, the Foundation, with the

support of the President's Science Adviser, organized and chaired the Interagency Working Group on University Research Instrumentation with representatives from the Department of Defense, the Department of Health and Human Services, the Department of Energy, the Department of Agriculture, and the National Aeronautics and Space Administration. This Working Group reviewed the nature of the problem and considered the Federal role and possible responses within the context of each agency's FY 1983 Budget Request.

In passing Section 222 of the Economic Recovery Tax Act of 1981 which permits an increased deduction for manufacturers who donate scientific research equipment to institutions of higher education, the Congress specifically recognized the need to upgrade the scientific equipment available to universities and to encourage an expansion of the corporate role in that effort. Similarly, State legislatures and local governments as well as university trustees, administrators and faculty might explore new, creative ways of financing the upgrading of such instrumentation and of giving it major priority in their budgetary deliberations.

INDUSTRY/UNIVERSITY COOPERATION

In the past few years, vigorous international economic competition, particularly in high-technology industries, has focused attention on the relation of basic science and engineering to advanced technologies. Since most of the Nation's basic research is conducted in academic institutions while most technological development occurs in the private sector, part of the attention has been directed to the potential for developing new links between universities and industry.

The FY 1983 Budget Request includes provision for the establishment of an additional Industry/University Cooperative Research Center. This will bring to six the total number of such centers initiated with Foundation support since this program was begun in the mid-1970's.

With "seed money" from NSF, each center provides a focus for research in a particular technical or scientific area, such as welding or polymer processing, selected jointly by a university and associated private firms. Proposals for such centers are evaluated competitively, using the peer review process, and Foundation participation depends on the potential of the proposed area for producing high quality scientific research. Eventually each center will be supported entirely by industrial funding as Foundation support is phased out.

A second effort, the Industry/University Cooperative Research program, will have made more than 300 awards by the end of FY 1982 to support individual research projects involving working cooperation between university and industry scientists and engineers. The FY 1983 Budget Request provides $6.0 million to continue this activity, which makes awards on a 50/50 cost sharing basis with other Foundation research programs, primarily engineering, chemistry, and materials research. The total level of this activity in FY 1983 is therefore $12.0 million.

Overall, however, the Foundation's role in stimulating areas of industry/university research cooperation can be only a small, catalytic one. Major initiatives for exploring the full range of possible cooperative activities must come from the academic and industrial sectors themselves. Though their objectives and roles in the national research and development system are different, they are, at many points, interdependent. Thus, the opportunity to identify and explore common ground in areas ranging from educational quality and skilled personnel shortages to scientific and engineering research instrumentation and mutual basic and applied research interests presents one of the major challenges of the 1980's.

SCIENCE AND ENGINEERING PERSONNEL SHORTAGES

Today the Nation is experiencing shortages of qualified teaching personnel in its colleges and universities in areas such as computer science, certain fields of engineering and earth sciences. The shortages result from rapid growth in selected high technology industries and the consequent increased demand for professionals in these specialties. High salaries and, in many instances, opportunities to work with research instrumentation at the frontiers of these rapidly developing technical areas appear to have placed academic institutions at a competitive disadvantage in the market.

In the fall of 1981, for example, it was estimated that almost 10 percent of faculty positions in engineering were vacant and nine out of ten engineering colleges were reporting increasing difficulties in recruiting new faculty. The problem extends to students as well, as more and more are attracted to industry, which is willing to hire holders of bachelor's and master's degrees at salaries which make the economic rewards for advanced degree work relatively unattractive. There is also evidence that secondary school teachers of mathematics and related disciplines are being caught up by the growing demand and are leaving the field of education for more economically attractive opportunities.

The FY 1983 Budget Request provides continuing support for a new, innovative program in electrical, computer, and systems engineering intended to increase opportunities for potential faculty members to conduct research in these fields. Full and part-time graduate students, new faculty, and engineers currently employed in industry interested in moving into academic positions are eligible for these multi-year research awards. In the case of graduate students or others employed outside of academia, receipt of the award is contingent on acceptance of a tenure-track position at an appropriate academic institution.

More generally, the selective emphasis in the Foundation's FY 1983 request on improving research instrumentation may also help improve the attractiveness of research and teaching careers in these and other fields. However, current trends clearly have broad, national implications for private industry and academic institutions well beyond the role which the Foundation can play. While NSF is seeking to address this challenge in innovative ways within

existing NSF programs and priorities, the solution will have to come ultimately from the increasing sensitivity of industry and academia to its dimensions and their willingness to take steps toward meeting it.

EXPANDING THE HUMAN RESOURCE POOL

The relative lack of participation by women and ethnic minorities in science and technology weakens national capabilities in industrial output, productivity growth and defense. In addition, shortages of highly skilled personnel in particular areas of science and technology are exacerbated by this situation. The valuable talents of minorities and women must be developed and employed in addressing these national needs.

The FY 1983 Budget Request addresses this issue in several different programs. The Minority Graduate Fellowship program of support to members of ethnic minority groups will fund about 50 new and 90 continuing awards. Support of the Minority Research Initiation program will be increased by 47 percent to a total of $2.5 million. This activity, which funds research by full-time minority faculty members at any institution who have had no previous Federal research support, has made about 35 awards at an average amount of $70,000 during the past two fiscal years.

Similarly, support for the Visiting Professorships for Women program will be doubled to a total of $1.0 million in FY 1983. This program, begun in FY 1982 to encourage careers for women in science and engineering and to give greater visibility to women researchers, provides a limited number of awards to women who hold doctorates or equivalent experience in science and engineering and have demonstrated independent research capability. Women working in industrial, academic or public sector positions are eligible to apply.

The Research Improvement in Minority Institutions program was also started in FY 1982 as part of the Foundation's response to the President's Executive Order 12320. Funding for the program will be quadrupled in the FY 1983 Budget Request to a total of $2.0 million. Supported activities may range from research equipment acquisition, to individual faculty research projects, to joint industry/university research collaboration at eligible institutions in order to improve their scientific and engineering research capability.

The Foundation is fully committed to expanding opportunities for women and ethnic minority group members to participate fully in scientific and engineering research careers. There are challenges here for the other institutions of science and engineering as well: scientific and professional societies; universities and colleges; private industry; and other Federal agencies. Each needs to examine its own policies and programs to insure that the research enterprise responds to opportunities for increasing the representation of these groups essential to the scientific and technical labor force.

RESEARCH CAREERS IN SCIENCE AND ENGINEERING

Another long-term issue underlying the current shortage of skilled scientific and engineering personnel is the declining emphasis on mathematics and physical science teaching in the Nation's elementary and secondary schools, a situation in stark contrast to other industrialized countries. According to a 1981 survey, fully 22 percent of high school mathematics teaching positions nationwide were vacant. Officials in 16 states characterized the situation as "critical." The nation-wide trend toward reduced high school enrollments in mathematics and science has been coupled with less stringent graduation requirements in these fields. In response, college admission requirements in science and mathematics have been reduced.

Opportunities for improving the situation for mathematics and science teaching in order to expand the future pool of scientific personnel will depend upon the sustained attention of state and local governments, and public and private educational institutions which have the primary responsibility for science and engineering education in this country. There is an opportunity for industry, universities and colleges, and scientific and professional groups to work with state and local officials and schools in improving science and mathematics instruction and to meet the Nation's future needs for skilled personnel.

The Foundation's major responsibilities lie in graduate education and training in research, which it supports through fellowships, stipends in research awards and by monitoring and evaluating personnel trends and the status of science and engineering education. In primary and secondary education NSF can play an important role by helping to identify critical needs and by encouraging scientific and professional societies, academic institutions, state and local governments, private industry, and other Federal agencies to meet these challenges.

The potential significance of this latter role is underlined by the recent establishment of a National Science Board Commission on Precollege Education in Mathematics, Science and Technology. This Commission will work with many national and local scientific, educational, industrial, and governmental officials and associations to identify specific needs and opportunities in science and engineering education; to assist these groups in planning to respond to their needs and opportunities; and to suggest innovative steps which the Foundation might take to focus national attention on them. The Commission's effort will provide a national resource for government officials and the public as they attempt to respond to educational needs in science and technology.

Some Significant Recent Accomplishments of NSF - Supported Projects

The new knowledge resulting from successful Foundation-funded projects provides the primary basis for assessing the effectiveness of Foundation programs and their management. During 1981, the results of work supported

under earlier NSF awards were reported at numerous scientific meetings and published in a wide variety of scientific journals and books. The following twelve items are examples of noteworthy scientific accomplishments of broad interest.

CONVERTING TOXIC WASTES INTO HARMLESS SUBSTANCES

Much of the Nation's chemical waste contains a class of toxic compound called halogenated hydrocarbons, used in such everyday items as aerosol sprays, cleaning fluids, certain plastics and clothing. Since most of these hydrocarbons are not biodegradable, they accumulate in the environment, creating a potential hazard.

Donald T. Sawyer, of the University of California, Riverside, and Julian Roberts, of the University of Redlands, have discovered a negatively charged form of oxygen known as a "superoxide" which can be used to break the tenacious carbon-chlorine bond of these toxic compounds. Their discovery resulted from a basic study of the electrochemistry of oxygen in special inert solvents. When an electric current is passed through hydrocarbon waste in water-free solution, the dissolved oxygen is transformed into a "superoxide." The hydrocarbon wastes are broken by the "superoxide" into harmless substances. According to the investigators, the process could be readily developed to reduce toxic wastes at industrial and commercial sites.

ROBOTIC "VISION"

The Robot Research Group of the University of Rhode Island, headed by John R. Birk and Robert B. Kelley, has developed an experimental robot which has "vision." Two television cameras with a computer "brain" enable the robot to select workpieces from a bin of randomly placed similar objects, pick them up, orient them, and carry them to a machine. The robot was developed from six years of research; it is the first robot that can efficiently select a class of work pieces from a bin using "vision." Not only does the robot have considerable promise for increased productivity in companies that manufacture industrial parts, but it also has potential applications in hazardous environments involving toxic chemicals, high temperatures or radioactive substances, and in environments inaccessible to human beings.

HOW NERVE CELLS LINK WITH EACH OTHER

Two investigators at the Cold Spring Harbor Laboratory in New York, Birgit Zipser and Ronald McKay, report finding unique molecule-sized "labels" on leech nerve cells. The "labels" may explain how single nerve cells in all animals know when to link up with each other. Such one-to-one connections, made correctly thousands of times in even the simplest animals, are the fundamental links that make possible learning, memory, sight, smell, motion

and other behavior. Because the fundamental characteristics of nerve cells are identical in all animals, including man, this finding has broad implications for all research on the central human nervous system.

ANTIBIOTIC FOUND IN ANCIENT BONES

Anthropologists David Greene and Dennis Van Gerven of the University of Colorado, George Armelagos of the University of Massachusetts, and Richard Adams of the University of Kentucky, have found tetracycline, an antibiotic, in bones that predate the discovery of modern antibiotics by at least 1,400 years. The bones were discovered on the west bank of the NIle River in a cemetery containing the remains of an early agricultural people who cultivated the flood plains of the Nile. The probable source of the antibiotic was a mold-like bacteria that grew on the grain cultivated and stored by these people. The presence of tetracycline in the diet could explain the extremely low infectious disease rate in this, and possibly other, ancient populations. It might also shed light on the development of natural resistance to antibiotics before modern antibiotics were formulated.

LARGEST 'HOLE' IN SPACE

Astronomers at the University of Michigan, Yale University, Kitt Peak National Observatory, and Mt. Wilson Observatory, have discovered a puzzling region of empty space so vast that ordinarily 2,000 galaxies the size of the Milky Way -- which has a diameter of about 100,000 light years -- would be found within its boundaries. The finding is considered scientifically important because the huge void offers a major new clue to the nature of the early universe and its evolution. The investigators are now trying to determine more precisely the void's boundaries and are investigating the possibility that matter is present there in some form other than galaxies.

GEOLOGICAL STRUCTURE SUGGESTS PRESENCE OF OIL

Although the climatic history of Europe and North America is known over a period of millions of years, that of Africa is not. Analyses of core samples taken from lake sediments are among the best ways of studying ancient climates, geological processes, and plant and animal life.

A basic research project involving examination of sediments from East African lakes was directed by two Duke University scientists, Daniel A. Livingston and Bruce R. Rosendahl and was supported jointly by NSF and ELF-Aquitaine, the French national oil company, with some contribution from Mobil Oil Company. While conducting seismic studies in East Africa's deep rift valley lakes the investigators found evidence that major deposits of oil may underlie a portion of the valley. Not only did the lake sediments contain

between 15 and 20 percent organic matter, but seismic recordings indicated that the geological structure under the lakes is folded and faulted in a way that would trap petroleum, if present.

BRAIN PROTEIN PLAYS ROLE IN LEARNING

Research undertaken by William F. Bennett of the University of Texas Health Science Center in Houston and Michael Browning and Gary Lynch of the University of California, Irvine, has identified a natural brain protein that may play a key role in learning by making it easier for signals to pass between nerve cells.

The protein, it was discovered, undergoes a dramatic change in chemical activity under the kind of electrical stimulation that characterizes learning. Changes in the chemical activity of the protein are, in turn, linked to the amount of calcium in nerve cells. This link is significant because the amount of calcium in a nerve cell controls the release of neurotransmitters, substances that carry chemical messages from one cell to another. It is suggested that enhanced communication between cells could lie at the roots of human learning.

LARGE CAPACITY INFORMATION STORAGE

Scientists at OMEX, a small electronics firm in Santa Clara, California, achieved a high-density archival memory capability using a focused laser beam to record information. The result provides storage density one or two orders of magnitude greater than magnetic storage technology. The unusual reliability and potential for greater storage density of optical recording attracted about $5 million in private, follow-on venture capital for development of a new product area, electronic filing.

DETECTING DISEASE-CAUSING VIRUSES

The need to develop reliable and cost-effective ways to detect disease-causing viruses in drinking water is intensifying because of an increase in the use of wastewater for human consumption. It is estimated that indirect use of wastewater supplies more than 100 million people throughout the world with drinking water.

George Belfort and D. M. Dziewulski, engineers at Rensselaer Polytechnic Institute, have developed and tested a new technique for concentrating minute quantities of these viruses so that they may be more easily and reliably detected. The method uses a special filter device packed with soda-straw-like fibers which are capable of retaining viruses while allowing water to pass through. Since no chemicals must be added to the water samples, highly turbid

water can be dealt with and standard, off-the-shelf equipment can be used. The new technique shows much promise relative to methods currently in use.

POLYURETHANE BLOOD VESSELS SOLVE PROBLEM IN HEART BYPASS SURGERY

In conducting by-pass heart surgery today, surgeons commonly remove from the patient either of two large veins of the leg just beneath the skin's surface, using this vein to replace blood vessels near the patient's heart that are blocked or damaged. Many patients simply don't have veins that are good enough for such transplants. Others, who have undergone such surgery, complain that the removal of the vein from the leg is more painful than the transplant itself.

A team of polymer scientists at the University of Utah, led by Donald J. Lyman, has eliminated these problems by their pioneering work in developing polyurethane blood vessels. The main stumbling block to the use of artificial blood vessels--clotting--was eliminated by extremely sophisticated basic research on the molecular structure of the polymer material, polyurethane. This research led to an understanding of the special molecular structure needed to control clotting and provided the basis for developing synthetic blood vessels that both had the correct surface structure and were able to pulsate -- expand and contract -- in response to the blood flow. The principal investigator estimated that up to 300,000 patients, annually, can benefit from this development.

MINERAL DEPOSITS ON SEA FLOOR

During the past four years, investigators from Woods Hole Oceanographic Institute in Massachusetts and Scripps Institution of Oceanography in California have conducted a program of basic research on the marine geology of hydrothermal vents. They have discovered new areas on the sea floor where cold seawater circulates through hot, newly-formed oceanic crust to form chimneys made of copper, zinc and iron sulfide. Samples of mud and recently deposited lava collected from the vent areas contain about 55 percent zinc sulfide, 300 parts per million silver, 3,200 parts per million copper, and 2,500 parts per million lead. Discovery of the new fields off Oregon, Mexico, and South America greatly expands knowledge of such deposits and indicates that other fields containing commercially valuable deposits of minerals may be found in tectonically similar locations on the sea floor.

ANTI-TUMOR AGENTS DISCOVERED

While carrying out a basic research project to learn more about soluble catalysts, substances which speed up or slow down the rate of chemical reactions without themselves undergoing chemical changes, George R. Newkome and his research group at Louisiana State University in Baton Rouge discovered a class of potential anti-tumor agents that might be more active and less toxic than the heavy metal drugs now used in cancer chemotherpy. Like most substances which are potential chemotherapeutic agents, these new compounds affect the speed of cell division. Since cancerous cells divide more often than their benign counterparts, they are more susceptible to attack. A lot more testing must be done to make the most effective anti-cancer agent. Because these new compounds are about 10,000 times more active towards DNA molecules than drugs in current use for cancer chemotherapy, much smaller dosages may be used, diminishing the problem of unacceptable side effects such as irreversible kidney damage.

BUDGET SUMMARY OF OBLIGATIONS BY ACTIVITY AND SUBACTIVITY SHOWING DOLLAR PERCENTAGE CHANGES, FY 1983/FY 1982

(Millions of Dollars)

Activity & Summary	Actual 1981	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/FY 1982 Amount	Difference FY 1983/FY 1982 Percent
RESEARCH & RELATED ACTIVITIES APPROPRIATION					
Mathematical and Physical Sciences					
Mathematical Sciences	$28.3	$31.2	$33.9	$2.7	8.7
Computer Research	22.3	25.7	29.3	3.6	14.0
Physics	72.1	75.3	81.7	6.4	8.5
Transfer of Responsibility to NSF	—0—	—0—	6.8	6.8	—0—
Subtotal, Physics	72.1	75.3	88.5	13.2	17.5
Chemistry	57.6	60.7	66.1	5.4	8.9
Materials Research	71.0	74.5	80.9	6.4	8.6
Transfer of Responsibility to DOE	5.2	5.5	—0—	5.5	-100.0
Subtotal, Materials Research	76.2	80.0	80.9	0.9	1.1
Subtotal	251.3	267.4	291.9	24.5	9.2
Net Transfer of Responsibilities	5.2	5.5	6.8	1.3	—0—
Subtotal, MPS	256.5	272.9	298.7	25.8	9.5
Engineering:					
Electrical, Computer & Systems Engineering	23.4	25.3	28.1	2.8	11.1
Chemical & Process Engineering	18.5	20.1	22.2	2.1	10.4
Civil & Environmental Engineering	27.1	28.3	30.0	1.7	6.0
Mechanical Sciences & Engineering	16.0	16.8	19.1	2.3	13.7
Interdisciplinary Research	(.3)	.3	.3	—0—	—0—
Subtotal	85.0	90.8	99.7	8.9	9.8
Transfer to U.S.G.S.	1.4	1.2	—0—	-1.2	-100.0
Subtotal, Engineering	86.4	92.0	99.7	7.7	8.4
Biological, Behavioral, and Social Sciences					
Physiology, Cellular & Molecular Biology	78.2	79.4	85.2	5.8	7.3
Environmental Biology	41.0	42.0	45.0	3.0	7.3
Behavioral and Neural Sciences	35.3	31.8	33.5	1.7	5.3
Social & Economic Science	25.1	17.6	17.8	.2	1.1
Information Sciences and Technology	5.9	5.2	5.2	—0—	—0—
Subtotal, BBS	185.5	176.0	186.7	10.7	6.1
Astronomical, Atmospheric, Earth and Ocean Sciences					
Astronomical Sciences	58.4	59.1	63.2	4.1	6.9
Atmospheric Sciences	69.3	70.0	74.8	4.8	6.9
Earth Sciences	27.9	29.2	34.4	5.2	17.8
Ocean Sciences	74.9	75.8	81.0	5.2	6.9
Arctic Research Program	5.8	5.9	6.3	.4	6.8
Subtotal, AAEO	236.3	240.0	259.7	19.7	8.2

BUDGET SUMMARY OF OBLIGATIONS BY ACTIVITY AND SUBACTIVITY SHOWING DOLLAR PERCENTAGE CHANGES, FY 1983/FY 1982 - CONTINUED

(Millions of Dollars)

Activity & Summary	Actual 1981	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/FY 1982 Amount	Difference FY 1983/FY 1982 Percent
Ocean Drilling Programs					
Deep Sea Drilling Project	17.0	14.5	14.0	-.5	-3.4
Advanced Ocean Drilling	—0—	5.5	—0—	-5.5	-100.0
Ocean Margin Drilling Program	5.0	—0—	—0—	—0—	—0—
Subtotal, ODP	22.0	20.0	14.0	-6.0	-30.0
U.S. Antarctic Program					
U.S. Antarctic Research Program	9.0	7.5	9.0	1.5	20.0
Operations Support	58.4	58.5	64.0	5.5	9.4
Transfer of Responsibility to NSF	—0—	—0—	13.4	13.4	—0—
Total, Operations Support	58.4	58.5	77.4	18.9	22.0
Subtotal, USAP	67.4	66.0	86.4	20.4	30.9
Scientific, Technological, and International Affairs					
Industrial Science and Technology Innovation	17.1	12.8	14.5	1.7	13.3
International Cooperative Scientific Activities	10.1	10.6	9.1	-1.5	-14.2
Intergovernmental and Public Service Science and Technology	2.5	0.5	0.5	—0—	—0—
Policy Research & Analysis	4.4	4.6	5.1	0.5	10.9
Science Resources Studies	3.1	3.0	3.5	0.5	16.7
Coordinated Agency-Wide Research Activities	16.6	8.8	11.3	2.5	28.5
Subtotal, STIA	53.8	40.3	44.0	3.7	9.2
Minority Institutions Sciences Improvement Program	(4.9)	(4.8)	3.3	3.3	—0—
Program Development and Management	59.2	63.5	63.1	-0.4	-0.7
Subtotal, Research and Related Activities Appropriation	960.6	964.0	1,035.14	71.4	7.4
Less Transfers of Responsibility	6.5	6.7	20.2	13.5	—0—
Total, Research and Related Activities Appropriation	967.1	970.7	1,055.6	84.9	8.7
Science and Engineering Education Activities Appropriation					
Scientific Personnel Improvement	33.4	16.8	15.0	-1.8	-10.7
Science Education Resources Improvement	17.8	—0—	—0—	—0—	—0—
Science Education Development and Research	10.9	2.2	—0—	-2.2	-100.0
Science Education Communication	8.6	1.2	—0—	-1.2	-100.0
NSB Commission on Pre-College Education	—0—	.7	—0—	—0—	—0—
Total, Science and Engineering Activities Appropriation	70.7	20.9	15.0	-5.9	-28.2
Special Foreign Currency Appropriation					
Research and Related Activities	2.9	4.6	2.2	-2.4	-52.5
Science Information	1.1	—0—	—0—	—0—	—0—
Total, Special Foreign Currency Appropriation	4.0	4.6	2.2	-2.4	-52.5
NSF Subtotal	1,035.3	989.5	1,052.6	63.0	6.4
Net Transfers of Responsibilities	6.5	6.7	20.2	13.5	—0—
Total, NSF	**1,041.8**	**996.2**	**1,072.8**	**76.5**	**7.7**

SUMMARY BUDGET INFORMATION BY ACTIVITY AND SUBACTIVITY FY 1981-FY 1983

The following tables summarize the National Science Foundation's FY 1981 through FY 1983 budgets by appropriation title.

Activity	Actual FY 1981	Amended Request FY 1982	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/82
A. Summary of Funding Level by Activity					
Research and Related Activities					
Mathematical and Physical Sciences	$256,484,247	$295,410,000	$272,900,000	$298,700,000	$25,800,000
Engineering	86,346,655	102,560,000	92,000,000	99,700,000	7,700,000
Biological, Behavioral and Social Sciences	185,582,539	171,980,000	176,000,000	186,700,000	10,700,000
Astronomical, Atmospheric, Earth and Ocean Sciences	236,291,406	253,150,000	240,000,000	259,700,000	19,700,000
Ocean Drilling Programs	21,999,999	26,000,000	20,000,000	14,000,000	-6,000,000
Antarctic Research Program	67,454,493	70,100,000	66,000,000	86,400,000	20,400,000
Scientific, Technological, and International Affairs	53,752,255	37,700,000	40,293,893	44,000,000	3,706,107
Minority Institutions Science Improvement Program	(4,981,000)*	(N/A)*	(4,800,000)*	3,287,000	3,287,000
Program Development and Management	59,207,459	63,200,000	63,515,037	63,081,000	-434,037
Subtotal, Research and Related Activities	967,119,053	1,020,100,000	970,708,930	1,055,568,000	84,859,070
Unobligated Balances, Deferrals and Other Adjustments	-20,460,053	—0—	-1,013,930	—0—	1,013,930
Research and Related Activities Appropriation	946,659,000	1,020,100,000	969,695,000	1,055,568,000	85,873,000
Science and Engineering Education Activities					
Scientific Personnel Improvement	33,369,803	9,900,000	16,800,000	15,000,000	-1,800,000
Science Education Resources Improvement	17,832,983	—0—	—0—	—0—	—0—
Science Education Development and Research	10,870,107	—0—	2,200,000	—0—	-2,200,000
Science Education Communication	8,590,716	—0—	1,200,000	—0—	-1,200,000
NSB Commission on Pre-College Education	—0—	—0—	700,000	—0—	-700,000
Subtotal, Science and Engineering Education Activities	70,663,609	9,900,000	20,900,000	15,000,000	-5,900,000
Unobligated Balances, Recissions, Transfers and Other Adjustments	40,391	—0—	—0—	—0—	—0—
Science and Engineering Education Activities Appropriation	70,704,000	9,900,000	20,900,000	15,000,000	-5,900,000
Special Foreign Currency Program	3,995,015	3,500,000	4,630,334	2,200,000	2,430,334
Unobligated Balances and Other Adjustments	1,004,985	—0—	-1,550,334	—0—	-1,550,334
Special Foreign Currency Appropriation	5,000,000	3,500,000	3,080,000	2,200,000	-880,000
TOTAL, NSF APPROPRIATIONS	1,022,363,000	1,033,500,000	993,675,000	1,072,768,000	79,093,000

Level of Funding by Program—Continued

Activity	Actual FY 1981	Amended Request FY 1982	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/82
B. Mathematical and Physical Sciences					
I. Mathematical Sciences					
Classical Analysis	$3,623,280	$4,530,000	$3,130,000	$3,340,000	$210,000
Modern Analysis	3,742,862	4,440,000	3,250,000	3,470,000	220,000
Geometric Analysis	—0—	—0—	3,020,000	3,220,000	200,000
Topology, Geometry and Foundations	6,030,148	6,370,000	—0—	—0—	—0—
Topology and Foundations	—0—	—0—	4,040,000	4,300,000	260,000
Algebra and Number Theory	4,904,469	5,685,000	5,030,000	5,360,000	330,000
Applied Mathematics	3,981,159	5,000,000	3,840,000	4,100,000	260,000
Statistics and Probability	3,126,060	3,555,000	3,290,000	3,510,000	220,000
Special Projects	2,862,253	4,140,000	5,600,000	6,600,000	1,000,000
Subtotal	$28,270,231	$33,720,000	$31,200,000	$33,900,000	$2,700,000
II. Computer Research					
Theoretical Computer Science	$3,221,146	$2,900,000	$3,150,000	$3,250,000	$100,000
Software Systems Science	3,289,108	3,150,000	3,200,000	3,400,000	200,000
Software Engineering	2,847,507	3,300,000	3,100,000	3,200,000	100,000
Intelligent Systems	2,748,383	3,200,000	3,000,000	3,200,000	200,000
Computer Systems Design	2,906,942	3,250,000	3,200,000	3,400,000	200,000
Coordinated Experimental Research	5,691,751	9,060,000	8,450,000	11,250,000	2,800,000
Special Projects	1,629,484	2,140,000	1,600,000	1,600,000	—0—
Subtotal	$22,334,321	$27,000,000	$25,700,000	$29,300,000	$3,600,000
III. Physics					
Elementary Particle Physics	$25,208,792	$28,630,000	$26,200,000	$28,400,000	$2,200,000
Intermediate Energy Physics	11,878,799	13,730,000	13,000,000	14,200,000	1,200,000
Nuclear Physics	13,215,740	14,780,000	12,650,000	13,500,000	850,000
Atomic, Molecular, and Plasma Physics	9,021,275	10,250,000	9,450,000	10,300,000	850,000
Theoretical Physics	8,936,600	10,050,000	9,500,000	10,400,000	900,000
Gravitational Physics	3,828,925	4,510,000	4,500,000	4,900,000	400,000
Subtotal	72,090,131	81,950,000	75,300,000	81,700,000	6,400,000
Transfer of Responsibility from DOE for MSU Phase II in FY 1983	—0—	—0—	—0—	6,800,000	6,800,000
Subtotal	$72,090,131	$81,950,000	$75,300,000	$88,500,000	$13,200,000
IV. Chemistry					
Structural Chemistry and Thermodynamics	$11,687,499	$13,840,000	$12,200,000	$13,300,000	$1,100,00
Chemical Physics	9,579,000	11,040,000	10,100,000	11,000,000	900,000
Chemical Dynamics	11,158,800	12,840,000	11,900,000	13,000,000	1,100,000
Chemical Analysis	6,549,858	6,990,000	6,900,000	7,500,000	600,000
Synthetic Inorganic and Organometallic Chemistry	6,573,319	7,290,000	7,000,000	7,600,000	600,000
Synthetic Organic and Natural Products Chemistry	6,938,854	7,970,000	7,300,000	7,900,000	600,000
Chemical Instrumentation	5,135,000	5,950,000	5,300,000	5,800,000	500,000
Subtotal	$57,622,330	$65,920,000	$60,700,000	$66,100,000	$5,400,000
V. Materials Research					
Solid State Physics	$8,953,272	$10,635,000	$9,630,000	$10,250,000	$620,000
Solid State Chemistry	5,586,000	6,580,000	6,010,000	6,850,000	840,000
Low Temperature Physics	5,216,494	6,035,000	5,390,000	5,750,000	360,000
Condensed Matter Theory	5,400,566	6,540,000	5,970,000	6,550,000	580,000
Metallurgy	7,531,615	9,300,000	8,050,000	8,700,000	650,000
Ceramics	4,263,976	4,800,000	4,620,000	4,900,000	280,000
Polymers	4,828,742	5,790,000	5,330,000	6,000,000	670,000
Materials Research Laboratories	21,342,539	23,540,000	22,500,000	24,200,000	1,700,000
National Magnet Laboratories	4,577,030	5,100,000	4,500,000	4,700,000	200,000

Level of Funding by Program—Continued

Activity	Actual FY 1981	Amended Request FY 1982	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/82
Synchrotron Radiation	2,834,000	2,500,000	2,000,000	2,400,000	400,000
Small Angle Neutron Scattering	480,000	500,000	500,000	600,000	100,000
Subtotal	71,014,234	81,320,000	74,500,000	80,900,000	6,400,000
Transfer of Responsibility to DOE for SSRL in FY 1983	5,153,000	5,500,000	5,500,000	—0—	-5,500,000
Subtotal	$76,167,234	$86,820,000	$80,000,000	$80,900,000	$900,000
TOTAL, MATHEMATICAL AND PHYSICAL SCIENCES	$256,484,247	$295,410,000	$272,900,000	$298,700,000	$25,800,000
C. Engineering					
I. Electrical, Computer, and Systems Engineering					
Automation, Bioengineering and Sensing Systems	$4,002,320	$4,915,000	$4,590,000	$5,090,000	$500,000
Electrical and Optical Communications	4,012,558	5,010,000	4,480,000	5,300,000	820,000
Computer Engineering	2,033,161	2,430,000	2,290,000	2,540,000	250,000
Quantum Electronics, Waves and Beams	3,548,413	4,520,000	4,170,000	4,670,000	500,000
Solid State and Microstructures Engineering	4,501,581	5,305,000	4,900,000	5,730,000	830,000
Systems Theory and Operations Research	3,646,852	4,620,000	4,270,000	4,770,000	500,000
Science and Technology to Aid the Handicapped	1,681,172	1,640,000	600,000	—0—	-600,000
Subtotal	$23,426,057	$28,440,000	$25,300,000	$28,100,000	$2,800,000
II. Chemical and Process Engineering					
Kinetics, Catalysis and Reaction Engineering	$3,016,454	$3,530,000	$3,300,000	$3,650,000	$350,000
Chemical and Biochemical Processes	4,292,653	4,740,000	4,100,000	4,450,000	350,000
Engineering Energetics	2,983,623	3,630,000	3,200,000	3,330,000	130,000
Thermodynamics and Transport Phenomena	3,100,700	3,830,000	3,300,000	3,500,000	200,000
Particulate and Multiphase Processes	2,105,321	2,940,000	2,900,000	3,370,000	470,000
Separation Processes	1,382,000	2,060,000	1,500,000	1,800,000	300,000
Minerals and Primary Materials Processing	1,572,633	1,000,000	1,800,000	2,100,000	300,000
Renewable Materials Engineering	(1,062,099)	(810,000)	(1,100,000)	(1,250,000)	(150,000)
Subtotal	$18,453,384	$21,730,000	$20,100,000	$22,200,000	$2,100,000
III. Civil and Environmental Engineering					
Geotechnical Engineering	$2,901,144	$2,850,000	$2,800,000	$3,300,000	$500,000
Structural Mechanics	2,563,139	3,340,000	2,600,000	2,900,000	300,000
Water Resources and Environmental Engineering	4,827,233	6,000,000	5,900,000	6,500,000	600,000
Earthquake Hazard Mitigation:					
Siting	$6,840,338	$8,450,000	$7,610,000	$7,750,000	$140,000
Design	8,184,066	7,720,000	7,280,000	7,400,000	120,000
Societal Response	1,794,920	2,480,000	2,110,000	2,150,000	40,000
Subtotal	16,819,324	18,650,000	17,000,000	17,300,000	300,000
Project Transferred to the U.S. Geological Survey	1,350,000	1,200,000	1,200,000	—0—	-1,200,000
Subtotal	$18,169,324	$19,850,000	$18,200,000	$17,300,000	-$900,000
Subtotal	$28,460,840	$32,040,000	$29,500,000	$30,000,000	$500,000

Level of Funding by Program—Continued

Activity	Actual FY 1981	Amended Request FY 1982	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/82
IV. Mechanical Engineering and Applied Mechanics					
Fluid Mechanics	$3,513,322	$4,520,000	$3,900,000	$4,400,000	$500,000
Heat Transfer	3,427,556	4,420,000	3,800,000	4,200,000	400,000
Solid Mechanics	3,148,880	3,730,000	3,600,000	3,850,000	250,000
Mechanical Systems	2,183,790	3,240,000	2,400,000	3,200,000	800,000
Technology Innovation Projects	875,000	900,000	—0—	—0—	—0—
Production Research	2,857,826	3,540,000	3,100,000	3,450,000	350,000
Subtotal	$16,006,374	$20,350,000	$16,800,000	$19,100,000	$2,300,000
V. Interdisciplinary Research					
Interdisciplinary Research	($298,128)	$ —0—	$300,000	$300,000	$ —0—
TOTAL, ENGINEERING	$86,346,655	$102,560,000	$92,000,000	$99,700,000	$7,700,000
D. Biological, Behavioral, and Social Sciences					
I. Physiology, Cellular, and Molecular Biology					
Molecular and Genetic Biosciences					
Biochemistry	$10,187,351	$10,902,000	$10,500,000	$11,100,000	$600,000
Biophysics	10,211,134	10,501,000	10,100,000	10,600,000	500,000
Genetic Biology	10,975,096	11,888,000	11,300,000	12,200,000	900,000
Metabolic Biology	10,066,439	11,199,000	10,780,000	11,500,000	700,000
Alternate Biological Resources	1,488,244	1,730,000	1,720,000	1,900,000	200,000
Subtotal	$42,928,264	$46,220,000	$44,400,000	$47,300,000	$2,900,000
Cellular and Physiological Biosciences					
Cellular Biology	$8,315,200	$8,200,000	$7,900,000	$8,400,000	$500,000
Cellular Physiology	5,630,752	6,100,000	5,900,000	6,300,000	400,000
Developmental Biology	9,604,382	9,650,000	9,300,000	10,000,000	700,000
Regulatory Biology	7,536,479	7,990,000	7,600,000	8,000,000	400,000
Subtotal	$31,086,813	$31,940,000	$30,700,000	$32,700,000	$2,000,000
Biological Instrumentation	4,219,400	4,500,000	4,300,000	5,200,000	900,000
Subtotal	$78,234,477	$82,660,000	$79,400,000	$85,200,000	$5,800,000
II. Environmental Biology					
Ecological Science					
Ecology	$6,504,939	$6,800,000	$6,900,000	$7,400,000	$500,000
Ecosystem Studies	14,204,658	15,880,000	14,600,000	15,600,000	1,000,000
Subtotal	$20,709,597	$22,680,000	$21,500,000	$23,000,000	$1,500,000
Systematic and Population Biology					
Systematic Biology	$8,413,992	$8,700,000	$8,500,000	$9,000,000	$500,000
Population Biology and Physiological Ecology	6,111,664	6,100,000	6,100,000	6,700,000	600,000
Biological Research Resources	5,816,988	6,400,000	5,900,000	6,300,000	400,000
Subtotal	$20,342,644	$21,200,000	$20,500,000	$22,000,000	$1,500,000
Subtotal	$41,052,241	$43,880,000	$42,000,000	$45,000,000	$3,000,000
III. Behavioral and Neural Sciences					
Neuroscience					
Neurobiology	$9,445,286	$10,200,000	$10,200,000	$10,800,000	$600,000
Sensory Physiology and Perception	7,271,855	7,960,000	6,900,000	7,400,000	500,000
Psychobiology	4,262,225	2,600,000	3,400,000	3,600,000	200,000
Subtotal	$20,979,366	$20,760,000	$20,500,000	$21,800,000	$1,300,000

Level of Funding by Program—Continued

Activity	Actual FY 1981	Amended Request FY 1982	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/82
Cognitive Science					
Memory and Cognitive Processes	$2,405,863	$1,400,000	$2,200,000	$2,300,000	$100,000
Social and Developmental Psychology	2,569,635	800,000	1,500,000	1,600,000	100,000
Applied Psychology	1,099,923	200,000	—0—	—0—	—0—
Linguistics	2,234,656	1,000,000	2,100,000	2,200,000	100,000
Subtotal	$8,310,077	$3,400,000	$5,800,000	$6,100,000	$300,000
Anthropology	5,966,131	5,000,000	5,500,000	5,600,000	100,000
Subtotal	$35,255,574	$29,160,000	$31,800,000	$33,500,000	$1,700,000
IV. Social and Economic					
Economics and Geography					
Economics	$9,382,600	$3,700,000	$6,300,000	$6,380,000	$80,000
Geography	1,201,350	450,000	700,000	700,000	—0—
Subtotal	$10,583,950	$4,150,000	$7,000,000	$7,080,000	$80,000
Social Measurement and Analysis					
Sociology	$3,036,040	$1,200,000	$2,200,000	$2,200,000	—0—
Measurement Methods and Data Resources	3,901,500	1,800,000	2,900,000	2,968,000	68,000
History and Philosophy of Science	1,090,000	500,000	900,000	900,000	—0—
Subtotal	$8,027,540	$3,500,000	$6,000,000	$6,068,000	$68,000
Political and Policy Sciences					
Political Science	$2,944,548	$1,050,000	$2,100,000	$2,100,000	—0—
Law & Social Sciences	874,000	400,000	1,100,000	1,100,000	—0—
Regulation and Policy Analysis	2,665,791	1,000,000	900,000	800,000	-100,000
Decision and Management Science	(360,000)	—0—	500,000	652,000	152,000
Subtotal	$6,484,339	$2,450,000	$4,600,000	4,652,000	52,000
Subtotal	$25,095,829	$10,100,000	$17,600,000	$17,800,000	$200,000
V. Information Sciences					
Information Science	$4,272,500	$4,400,000	$4,000,000	$4,000,000	$ —0—
Information Technology	282,884	700,000	400,000	400,000	—0—
Information Impact	1,389,034	1,080,000	800,000	800,000	—0—
Subtotal	$5,944,418	$6,180,000	$5,200,000	$5,200,000	$ —0—
TOTAL, BIOLOGICAL, BEHAVIORAL AND SOCIAL SCIENCES	$185,562,539	$171,980,000	$176,000,000	$186,700,000	$10,700,000
E. Astronomical, Atmospheric, Earth, and Ocean Sciences					
I. Astronomical Sciences					
Astronomy Project Support					
Solar System Astronomy	$1,460,243	$1,596,000	$1,425,000	$1,510,000	$85,000
Stars and Stellar Evolution	4,241,540	4,673,000	4,220,000	4,485,000	265,000
Stellar Systems and Motion	1,317,690	1,520,000	1,325,000	1,400,000	75,000
Galactic and Extragalactic Astronomy	6,372,802	7,063,000	6,570,000	7,015,000	445,000
Astronomical Instrumentation and Development	5,911,863	6,328,000	6,000,000	6,500,000	500,000
Radio Spectrum Management	99,480	100,000	100,000	100,000	—0—
Subtotal	$19,403,618	$21,280,000	$19,640,000	$21,010,000	$1,370,000

Level of Funding by Program—Continued

Activity	Actual FY 1981	Amended Request FY 1982	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/82
National Astronomy and Ionosphere Center					
Scientific Research Support	$5,438,000	$6,127,000	$5,635,000	$6,005,000	$370,000
Construction	284,000	55,000	—0—	—0—	—0—
Less NASA Support	-315,000	-315,000	-315,000	-315,000	—0—
Subtotal	$5,407,000	$5,867,000	$5,320,000	$5,690,000	$370,000
Kitt Peak National and Cerro-Tololo Inter-American Observatories					
Scientific Research Support	$16,595,850	$18,411,000	$16,972,000	$18,155,000	$1,183,000
Management Fee	319,000	333,000	328,000	335,000	7,000
Subtotal	$16,914,850	$18,744,000	$17,300,000	$18,490,000	$1,190,000
National Radio Astronomy Observatory					
Scientific Research Support	$14,555,000	$15,567,000	$14,545,000	$15,555,000	$1,010,000
Management Fee	235,000	250,000	295,000	315,000	20,000
Subtotal	$14,790,000	$15,817,000	$14,840,000	$15,870,000	$1,030,000
Sacramento Peak Observatory					
Scientific Research Support	$2,159,000	$2,389,000	$2,317,000	$2,480,000	$163,000
Management Fee	46,000	49,000	49,000	50,000	1,000
Less DOD Support	-345,000	-366,000	-366,000	-390,000	-24,000
Subtotal	$1,860,000	$2,072,000	$2,000,000	$2,140,000	$140,000
Subtotal, Astronomical Sciences	$58,375,468	$63,780,000	$59,100,000	$63,200,000	$4,100,000
II. Atmospheric Sciences					
Atmospheric Project Support					
Aeronomy	$6,150,170	$6,700,000	$6,800,000	$7,000,000	$200,000
Atmospheric Chemistry	4,671,658	5,340,000	4,900,000	5,700,000	800,000
Climate Dynamics	5,698,992	6,350,000	5,750,000	6,550,000	800,000
Experimental Meteorology	3,096,332	3,260,000	3,000,000	3,500,000	500,000
Global Atmospheric Research Program(GARP)	6,063,997	5,650,000	5,700,000	5,750,000	50,000
Meteorology	6,570,696	6,950,000	6,550,000	7,300,000	750,000
Solar Terrestrial Research	5,369,607	5,850,000	5,500,000	6,000,000	500,000
Subtotal	$37,621,452	$40,100,000	$38,200,000	$41,800,000	$3,600,000
National Center for Atmospheric Research					
Atmospheric Analysis and Prediction	$2,367,441	$3,131,000	$2,672,000	$2,906,000	$234,000
Atmospheric Chemistry and Aeronomy	1,701,008	1,875,000	2,032,000	2,220,000	188,000
Convective Storms	2,575,447	1,517,000	1,837,000	1,997,000	160,000
Advanced Study Program	1,003,563	979,000	1,020,000	1,108,000	88,000
High Altitude Observatory	2,544,433	2,995,000	2,763,000	3,011,000	248,000
Atmospheric Technology	5,768,970	6,359,200	7,443,000	6,012,000	-1,431,000
Scientific Computing	6,468,250	6,886,800	5,350,000	7,544,000	2,194,000
Administration and Support Services	3,521,520	4,061,000	3,697,000	4,006,000	309,000
Physical Plant Operation and Maintenance	2,741,865	2,941,000	2,951,000	3,396,000	445,000
Contractor Fee	535,000	535,000	535,000	800,000	265,000
Subtotal	$29,227,497	$31,280,000	$30,300,000	$33,000,000	$2,700,000
National Scientific Balloon Facility	$2,420,000	$1,850,000	$1,500,000	$ —0—	-$1,500,000
Subtotal, Atmospheric Sciences	$69,268,949	$72,230,000	$70,000,000	$74,800,000	$4,800,000

Level of Funding by Program—Continued

Activity	Actual FY 1981	Amended Request FY 1982	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/82
III. Earth Sciences					
Stratigraphy and Paleontology	$3,812,884	$4,150,000	$3,900,000	$4,450,000	$550,000
Environmental Geosciences	1,596,271	1,700,000	2,300,000	2,600,000	300,000
Crustal Structure and Tectonics	4,264,050	4,650,000	4,350,000	5,000,000	650,000
Seismology and Deep Earth Structure	4,656,936	5,050,000	5,300,000	6,100,000	800,000
Experimental and Theoretical Geophysics	3,674,753	3,850,000	3,100,000	3,600,000	500,000
Petrogenesis and Mineral Resources	3,243,412	3,400,000	3,450,000	3,950,000	500,000
Mantle Geochemistry	2,687,011	3,000,000	2,800,000	3,200,000	400,000
Experimental and Theoretical Geochemistry	3,925,828	4,320,000	4,000,000	5,500,000	1,500,000
Subtotal	$27,861,145	$30,120,000	$29,200,000	$34,400,000	$5,200,000
IV. Ocean Sciences					
Ocean Science Research					
Physical Oceanography	$14,690,109	$14,700,000	$13,700,000	$14,300,000	$600,000
Marine Chemistry	10,253,651	10,300,000	10,400,000	11,100,000	700,000
Submarine Geology and Geophysics	12,362,317	13,620,000	12,000,000	12,800,000	800,000
Biological Oceanography	10,228,612	10,700,000	10,700,000	11,800,000	1,100,000
Subtotal	$47,534,689	$49,320,000	$46,800,000	$50,000,000	$3,200,000
Oceanographic Facilities and Support					
Operations	$23,269,591	$25,900,000	$24,000,000	$25,000,000	$1,000,000
Oceanographic Technology Program	4,168,171	4,500,000	5,000,000	6,000,000	1,000,000
Subtotal	$27,437,762	$30,400,000	$29,000,000	$31,000,000	$2,000,000
Subtotal, Ocean Sciences	$74,972,451	$79,720,000	$75,800,000	$81,000,000	$5,200,000
V. Arctic Research Program					
Atmospheric Sciences	$783,886	$975,000	$800,000	$900,000	$100,000
Biological Sciences	1,698,874	1,950,000	1,725,000	1,800,000	75,000
Earth Sciences	845,102	1,100,000	1,000,000	1,100,000	100,000
Glaciology	1,480,621	900,000	1,075,000	1,125,000	50,000
Oceanography	872,910	1,200,000	1,125,000	1,200,000	75,000
Information and Advisory Services	132,000	175,000	175,000	175,000	—0—
Subtotal	$5,813,393	$6,300,000	$5,900,000	$6,300,000	$400,000
TOTAL, ASTRONOMICAL, ATMOSPHERIC, EARTH AND OCEAN SCIENCES	$236,291,406	$253,150,000	$240,000,000	$259,700,000	$19,700,000
F. Ocean Drilling Programs					
I. Deep Sea Drilling Project					
Deep Sea Drilling Project	$22,596,560	$26,000,000	$24,700,000	$24,000,000	−$700,000
Less Foreign Funding	−5,596,560	−10,000,000	−9,000,000	−10,000,000	−1,000,000
Less Other U.S. Agencies	—0—	−2,000,000	−1,200,000	—0—	1,200,000
Subtotal	$17,000,000	$14,000,000	$14,500,000	$14,000,000	−$500,000
II. Ocean Margin Drilling					
Ocean Margin Drilling	$8,139,999	$24,000,000	$ —0—	$ —0—	$ —0—
Less Industry Contribution	−3,140,000	−12,000,000	—0—	—0—	—0—
Subtotal	$4,999,999	$12,000,000	$ —0—	$ —0—	$ —0—
III. Advanced Ocean Drilling					
Advanced Ocean Drilling	$ —0—	$ —0—	$5,000,000	$ —0—	−$5,500,000
TOTAL, OCEAN DRILLING PROGRAMS	$21,999,999	$26,000,000	$20,000,000	$14,000,000	−$6,000,000

Level of Funding by Program—Continued

Activity	Actual FY 1981	Amended Request FY 1982	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/82
G. U.S. Antarctic Program					
I. U.S. Antarctic Research Program					
Atmospheric Sciences	$2,171,911	$1,900,000	$1,900,000	$1,900,000	$ —0—
Biological Sciences	2,266,470	2,000,000	2,000,000	2,200,000	200,000
Earth Sciences	1,698,204	1,100,000	1,100,000	1,500,000	400,000
Glaciology	1,063,514	900,000	900,000	1,400,000	500,000
Oceanography	1,265,411	1,000,000	1,000,000	1,350,000	350,000
Information and Advisory Services	575,664	600,000	600,000	650,000	50,000
Subtotal	$9,041,174	$7,500,000	$7,500,000	$9,000,000	$1,500,000
II. Operations and Support Program					
Direct Science Support	$8,959,900	$9,687,000	$10,100,000	$10,100,000	$ —0—
Base Level Support	37,279,619	39,848,000	39,442,000	41,300,000	1,858,000
Major Construction and Procurement	12,173,800	13,065,000	8,958,000	12,600,000	3,642,000
Subtotal	58,413,319	62,600,000	58,500,000	64,000,000	5,500,000
Transfer of Responsibility for Icebreaker Support	—0—	—0—	—0—	13,400,000	13,400,000
Subtotal	$58,413,319	$62,600,000	$58,500,000	$77,400,000	$18,900,000
TOTAL, U.S. ANTARCTIC PROGRAM	$67,454,493	$70,100,000	$66,000,000	$86,400,000	$20,400,000
H. Industrial Science and Technological Innovation					
I. Industrial Science and Technological Innovation					
Industry/University Cooperative Research Projects	$8,111,237	$9,500,000	$5,500,000	$6,000,000	$500,000
Small Business Innovation Research	4,971,955	5,000,000	5,000,000	5,500,000	500,000
Industry/University Cooperative Research Centers	1,505,320	1,700,000	1,500,000	2,000,000	500,000
University-Based Innovation Centers	1,304,766	—0—	—0—	—0—	—0—
Innovation Processes Research	1,169,772	1,000,000	800,000	1,000,000	200,000
Subtotal	$17,063,050	$17,200,000	$12,800,000	$14,500,000	$1,700,000
II. International Cooperative Scientific Activities					
Scientific Cooperation with Europe	$3,251,741	$5,100,000	$3,490,000	$3,900,000	$410,000
Scientific Cooperation with Asia	2,399,718	3,200,000	3,400,000	3,400,000	—0—
Scientific Cooperation with Africa and Latin America	1,024,693	1,500,000	1,450,000	1,800,000	350,000
International Scientific Organizations and Resources	2,700,000	—0—	2,260,000	—0—	-2,260,000
International Travel	697,726	800,000	—0—	—0—	—0—
Subtotal	$10,073,878	$10,600,000	$10,600,000	$9,100,000	-$1,500,000
III. Intergovernmental Programs and Public Service Science and Technology					
Intergovernmental Programs					
Local Government	$1,129,273	—0—	—0—	—0—	—0—
State Government	270,000	—0—	—0—	—0—	—0—
Federal Technology & Information Transfer	—0—	—0—	—0—	—0—	—0—
State Science Engineering & Technology	599,526	—0—	—0—	—0—	—0—
Subtotal	$1,998,799	—0—	$500,000	$500,000	—0—

Level of Funding by Program—Continued

Activity	Actual FY 1981	Amended Request FY 1982	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/82
Public Service Science and Technology					
Science for Citizens	(1,109,266)	—0—	—0—	—0—	—0—
Ethics and Values in Science and Technology	(1,956,425)	1,700,000	—0—	—0—	—0—
Appropriate Technology	499,600	—0—	—0—	—0—	—0—
Subtotal	$499,660	—0—	—0—	—0— —0—	
Subtotal	$2,498,459	$1,700,000	$500,000	$500,00	—0—
IV. Policy Research and Analysis					
Socioeconomic Effects of Science and Technology	$1,877,690	$2,100,000	$1,650,000	$1,750,000	$100,000
Technology Assessment and Risk Analysis	1,435,677	1,500,000	1,300,000	1,350,000	50,000
Environment,Energy and Resources	1,100,759	1,100,000	950,000	1,000,000	50,000
Ethics and Values in Science and Technology	(1,956,425)	(1,700,000)	700,000	1,000,000	300,000
Subtotal	$4,414,126	$4,700,000	$4,600,000	$5,100,000	$500,000
V. Science Resources Studies					
Scientific and Technical Personnel	$1,533,213	2,100,000	$1,600,000	$1,600,000	$ —0—
Funding of Science and Technology	817,960	800,000	900,000	1,200,000	300,000
Modeling and Special Science and Technology Indicators	744,050	600,000	500,000	700,000	200,000
Subtotal	$3,095,223	$3,500,000	$3,000,000	$3,500,000	$500,000
VI. Coordinated Agency-Wide Research Activities					
NSF Planning and Evaluation	$1,841,303	$ —0—	$2,293,893	$2,500,000	$206,107
Two-and-Four-Year College Research Instrumentation	2,799,426	—0—	—0—	—0—	—0—
Regional Instrumentation Facilities	3,352,851	—0—	—0—	—0—	—0—
Visiting Professorships for Women	—0—	—0—	500,000	1,000,000	500,000
Minority Research Initiation	1,395,000	—0—	1,700,000	2,500,000	800,000
Research Improvement in Minority Institutions	—0—	—0—	500,000	2,000,000	1,500,000
Experimental Program to Stimulate Competitive Research	3,428,517	—0—	3,000,000	2,500,000	-500,000
Postdoctoral Fellowships	761,423	—0—	—0—	—0—	—0—
Integrated Basic Research	2,559,999	—0—	—0—	—0—	—0—
Alan T. Waterman Award	150,000	—0—	(150,000)	(150,000)	—0—
International Council of Scientific Unions	319,000	—0—	800,000	800,000	—0—
Subtotal	$16,607,519	$ —0—	$8,793,893	$11,300,000	$2,506,107
TOTAL, SCIENTIFIC, TECHNOLOGICAL AND INTERNATIONAL AFFAIRS	$53,752,255	$37,700,000	$40,293,893	$44,000,000	$3,706,107
I. Minority Institutions Science Improvement					
Minority Institutions Science Improvement Program	($4,981,000)	N/A	($4,800,000)	$3,287,000	$3,287,000

Level of Funding by Program—Continued

Activity	Actual FY 1981	Amended Request FY 1982	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/82
J. Program Development and Management	$59,207,459	$63,200,000	$63,515,037	$63,081,000	-$434,037
Full-time Equivalent Employment—Permanent	1,142	N/A	1,110	1,066	-44
Full-time Equivalent Employment—Other	171	N/A	191	172	-19
Full-time Equivalent Employment—Total	1,313	1,341	1,301	1,238	-63
Subtotal, Research and Related Activities	$967,119,053	$1,020,100,000	$970,708,930	$1,055,568,000	$84,859,070
Unobligated Balances, Deferrals Other Adjustments	-$20,460,053	—0—	-$1,013,930	—0—	$1,013,930
Research and Related Activities Appropriation	$946,659,000	$1,020,100,000	$969,695,000	$1,055,568,000	$85,873,000
K. Science and Engineering Education					
I. Personnel Improvement					
Faculty Improvement	$10,176,635	$ —0—	$800,000	$ —0—	-$800,000
Graduate Research Fellowships	14,028,171	9,900,000	15,000,000	15,000,000	—0—
Student Oriented Programs	5,686,121	—0—	—0—	—0—	—0—
Minorities, Women and the Physically Handicapped	3,478,876	—0—	1,000,000	—0—	-1,000,000
Subtotal	$33,369,803	$9,900,000	$16,800,000	$15,000,000	-$1,800,000
II. Science Education Resource Improvement					
Comprehensive Assistance to Undergraduate Science Education (CAUSE)	$8,895,450	$ —0—	$ —0—	$ —0—	—0—
Undergraduate Instructional Improvement	6,170,572	—0—	—0—	—0—	—0—
Resource Centers for Science and Engineering	2,766,961	—0—	—0—	—0—	—0—
Subtotal	$17,832,983	$ —0—	$ —0—	$ —0—	$ —0—
III. Science Education Development and Research					
Development in Science Education	$6,155,691	$ —0—	$1,700,000	$ —0—	-$1,700,000
Research in Science Education	4,714,416	—0—	500,000	—0—	-500,000
Subtotal	$10,870,107	$ —0—	$2,200,000	$ —0—	-$2,200,000
IV. Science Education Communication					
Public Understanding of Science	$4,301,310	$ —0—	$1,200,000	$ —0—	-$1,200,000
Information Dissemination for Science Education	1,223,715	—0—	—0—	—0—	—0—
Subtotal	5,525,025	—0—	1,200,000	—0—	-1,200,000
Programs Administered by STIA	3,065,691	—0—	—0—	—0—	—0—
Subtotal	$8,590,716	$ —0—	$1,200,000	$ —0—	-$1,200,000
V. NSB Commission on Pre-College Education	$ —0—	$ —0—	$700,000	$ —0—	-$700,000
TOTAL, SCIENCE AND ENGINEERING EDUCATION	$70,663,609	$9,900,000	$20,900,000	$15,000,000	-$5,900,000

Level of Funding by Program—Continued

Activity	Actual FY 1981	Amended Request FY 1982	Current Plan FY 1982	Estimate FY 1983	Difference FY 1983/82
Unobligated Balances, Recissions, Transfers and Other Adjustments	$40,391	—0—	—0—	—0—	—0—
Science and Engineering Education Activities Appropriation	$70,704,000	$9,900,000	$20,900,000	$15,000,000	-$5,900,000
L. Special Foriegn Currency Program					
Research and Related Activites	$2,945,015	$2,500,000	$4,630,334	$2,200,000	-$2,430,334
Science Information	1,050,000	1,000,000	—0—	—0—	—0—
Subtotal	$3,995,015	$3,500,000	$4,630,334	$2,200,000	-$2,430,334
TOTAL, SPECIAL FOREIGN CURRENCY PROGRAM	$3,995,015	$3,500,000	$4,630,334	$2,200,000	-$2,430,334
Unobligated Balances and Other Adjustments	$1,004,985	—0—	-$1,530,334	—0—	$1,550,334
Special Foreign Currency Program	$5,000,000	$3,500,000	$3,080,000	$2,200,000	-$880,000
TOTAL NSF APPROPRIATIONS	$1,022,363,000	$1,033,500,000	$993,675,000	$1,072,768,000	$79,093,000

Figures in parentheses are non-add for comparison purposes only.